# SCIENCE FLASH NEWS

No. 7/2025
July

# Physicists still divided about quantum world, 100 years on

The theory of quantum mechanics has transformed daily life since being proposed a century ago, yet how it works remains a mystery—and physicists are deeply divided about what is actually going on, a survey in the journal *Nature* said Wednesday.

"Shut up and calculate!" is a famous quote in quantum physics that illustrates the frustration of scientists struggling to unravel one of the world's great paradoxes.

For the last century, equations based on quantum mechanics have consistently and accurately described the behavior of extremely small objects. However, no one knows what is happening in the physical reality behind the mathematics.

The problem started at the turn of the 20th century, when scientists realized that the classical principles of physics did not apply to things on the level of atoms.

Bafflingly, photons and electrons appear to behave like both particles and waves. They can also be in different positions simultaneously—and have different speeds or levels of energy.

In 1925, Austrian physicist Erwin Schroedinger and Germany's Werner Heisenberg developed a set of complex mathematical tools that describe quantum mechanics using probabilities.

This "wave function" made it possible to predict the results of measurements of a particle.

These equations led to the development of a huge amount of modern technology, including lasers, LED lights, MRI scanners and the transistors used in computers and phones.

But the question remained: what exactly is happening in the world beyond the math?

https://phys.org/news/2025-07-physicists-quantum-world-years.html

# A new open-source program for quantum physics helps researchers obtain results in record time

Scientists at the Institute for Photonic Quantum Systems (PhoQS) and the Paderborn Center for Parallel Computing (PC2) at Paderborn University have developed a powerful open-source software tool that allows them to simulate light behavior in quantum systems.

The unique feature of this tool, named "Phoenix," is that researchers can use it to very quickly investigate complex effects to a level of detail that was previously unknown, and all without needing knowledge of high-performance computing. The results have now been published in *Computer Physics Communications*.

Phoenix solves equations that describe how light interacts with material at the quantum level, which is essential for understanding and for the design of future technologies such as quantum computers and advanced photonic devices.

"More specifically, we are looking here at so-called non-linear Schrödinger and Gross-Pitaevskii equations in two spatial dimensions. Phoenix's design means that it can run on standard laptops or high-performance GPUs and is up to a thousand times faster and up to 99.8% more energy-efficient than conventional tools," explains Professor Stefan Schumacher from PhoQS.

Phoenix is available to researchers anywhere in the world free of charge. The software is already being used to study new physical effects in rare quantum states of light and has the ability to help scientists to better understand and monitor light at the smallest scales.

*https://phys.org/news/2025-07-source-quantum-physics-results.html*

# Researchers develop flexible fiber material for self-powered health-monitoring sensors

Could clothing monitor a person's health in real time, because the clothing itself would be a self-powered sensor? A new material created through electrospinning, which is a process that draws out fibers using electricity, brings this possibility one step closer.

A team led by researchers at Penn State has developed a new fabrication approach that optimizes the internal structure of electrospun fibers to improve their performance in electronic applications. The team has published its findings in the *Journal of Applied Physics*.

This novel electrospinning approach could open the door to more efficient, flexible and scalable electronics for wearable sensors, health monitoring and sustainable energy harvesting, according to Guanchun Rui, a visiting postdoctoral student in the Department of Electrical Engineering and the Materials Research Institute and co-lead author of the study.

The material is based on poly(vinylidene fluoride-trifluoroethylene), or PVDF-TrFE, a lightweight, flexible polymer known for its ability to generate an electric charge when pressed or bent. That quality, called piezoelectricity, makes it a strong candidate for use in electronics that convert motion into energy or signals.

*https://phys.org/news/2025-07-flexible-fiber-material-powered-health.html*

# Physicists discover new state of quantum matter

Researchers at the University of California, Irvine have discovered a new state of quantum matter. The state exists within a material that the team reports could lead to a new era of self-charging computers and ones capable of withstanding the challenges of deep space travel.

"It's a new phase of matter, similar to how water can exist as liquid, ice or vapor," said Luis A. Jauregui, professor of physics & astronomy at UC Irvine and corresponding author of the new paper in *Physical Review Letters*.

"It's only been theoretically predicted—no one has ever measured it until now."

This new phase is like a liquid composed of electrons and their counterparts, known as "holes," spontaneously pairing and forming exotic states known as excitons. Unusually, the electrons and holes spin together in the same direction.

"It's its own new thing," Jauregui said. "If we could hold it in our hands, it would glow a bright, high-frequency light."

The phase exists in a material developed at UC Irvine by Jinyu Liu, a postdoctoral researcher in Jauregui's lab and the first author of the paper. Jauregui and his team measured the phase using high magnetic fields at the Los Alamos National Laboratory (LANL) in New Mexico.

https://phys.org/news/2025-07-physicists-state-quantum.html

# New microscopy method reveals detailed images of complex biological tissues

Until today, skin, brain, and all tissues of the human body were difficult to observe in detail with an optical microscope, since the contrast in the image was hindered by the high density of their structures. The research group of the Molecular Microscopy and Spectroscopy Lab at the Istituto Italiano di Tecnologia (IIT-Italian Institute of Technology) in Genoa has devised a new method that allows scientists to see and photograph biological samples in all their complexity, obtaining clear and detailed images. The new technique has been made available to the scientific community in "open science" mode, representing an advantage in the biomedical field, since it allows us to observe active cells, even in the presence of diseases, as well as to understand how drugs interact with living tissues.

The work was published recently in the journal *Nature Photonics* and is part of the research conducted by the group of Giuseppe Vicidomini, Principal Investigator of the Molecular Microscopy and Spectroscopy Lab, within the Brighteyes project.

The objective of the project was the use of new single-photon sensors to develop new optical microscopy techniques capable of observing biomolecular processes inside a living cellular system, such as organoids, in order to study their behavior and understand the causes of certain pathologies and the process of human aging. The project also led to several innovations that have already reached the market, thanks to international industrial collaborations and the creation of the start-up Genoa Instruments.

https://phys.org/news/2025-07-microscopy-method-reveals-images-complex.html

# New study shows how sweat really forms

If you're currently experiencing a hot summer, the chances are the sweat is pouring off you, soaking your clothing. This clear, odorless substance is a vital component of a healthy bodily function that helps cool you down and prevent overheating. However, the process by which sweat forms and emerges from the skin is more intricate than previously thought.

Sweat may often appear as a series of discrete droplets seeping from the skin, but a new study in the *Journal of the Royal Society Interface* tells a different story. Instead of forming distinct beads, sweat rises like a tide through the pores to saturate the top layer of skin. It gathers in a shallow pool in each pore before merging with others to form a complete film across the skin's surface.

"Our findings challenge the traditional conceptualization of sweat emerging from pores as hemispherical droplets, demonstrating that sweat commonly forms a shallow meniscus in the pore," wrote Konrad Rykaczewski, the study's corresponding author. This is why it doesn't take long for a T-shirt to become drenched on a sweltering day.

https://phys.org/news/2025-07-new-study-shows-how-sweat.html

# Physicists discover aluminum-20, a new three-proton-emitting isotope

Radioactive decay is a fundamental process in nature by which an unstable atomic nucleus loses energy by radiation. Studying nuclear decay modes is crucial for understanding properties of atomic nuclei. In particular, exotic decay modes like proton emission provide essential spectroscopic tools for probing the structure of nuclei far from the valley of stability—the region containing stable nuclei on the nuclear chart.

In a study published in *Physical Review Letters* on July 10, physicists from the Institute of Modern Physics (IMP) of the Chinese Academy of Sciences (CAS) and their collaborators have reported the first observation and spectroscopy of aluminum-20, a previously unknown and unstable isotope that decays via the rare process of three-proton emission.

"Aluminum-20 is the lightest aluminum isotope that has been discovered so far. Located beyond the proton drip line, it has seven fewer neutrons than the stable aluminum isotope," said Associate Prof. Xu Xiaodong from IMP, first author of the study.

Using an in-flight decay technique at the Fragment Separator of the GSI Helmholtz Center for Heavy Ion Research in Darmstadt, Germany, the researchers measured angular correlations of aluminum-20's decay products and discovered the previously unknown nucleus aluminum-20.

***https://phys.org/news/2025-07-physicists-aluminum-proton-emitting-isotope.html***

# Thank you!

**Edited by**

**Adrian-Sorin Gruia, Ph.D**