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First observation of optical Magnus effect could sharpen quantum computer control

Table tennis professionals are true masters at redirecting fast-moving projectiles. Putting a targeted spin on a serve can make the little white ball fly straight toward the edge of the table but then, at the last moment, take a sharp curve into the left corner. The physical phenomenon behind this sporting trick is known as the Magnus effect. It acts on balls of all sizes and has helped decide more than a few soccer matches.

An international research collaboration at the Paul Scherrer Institute PSI has now taken the leap from ball to atom, experimentally demonstrating the so-called optical Magnus effect for the first time. In this case, however, there is no atom flying along a curved trajectory. Instead, the researchers direct a tightly focused laser beam at a single ion and observe the resulting interaction.

They were able to show that the point of maximum interaction is shifted sideways—an important finding for the development of quantum computers in which laser light is used to precisely control qubits. The researchers report their findings in the journal *Physical Review Letters*.

https://phys.org/news/2026-08-optical-magnus-effect-sharpen-quantum.html

One molecule, one photon: Entanglement makes an imperceptible recoil measurable

For decades, light has been used to understand the molecular structures of matter. A sample is irradiated with light, and measurements determine the wavelengths at which it is absorbed. Since each molecule absorbs light at very specific wavelengths that depend on its structure, the resulting absorption spectrum acts like a molecular fingerprint. For individual molecules, however, this signal is vanishingly small and mostly indistinguishable from noise.

Using an elegant quantum physics trick, the team led by Philipp Schindler from the Department of Experimental Physics at the University of Innsbruck has now succeeded in measuring the spectrum of a single calcium hydroxide molecule.

The work is published in the journal *Nature*.

The basic idea draws from quantum information processing. In a technique known as quantum logic spectroscopy, two ions are coupled via their electric repulsion: a hard-to-access molecular ion and an easily controllable auxiliary atom move together in an ion trap, exchanging information in the process.

In this way, techniques originally developed for quantum computers can be applied to molecules that are otherwise difficult to study using conventional methods.

https://phys.org/news/2026-08-molecule-photon-entanglement-imperceptible-recoil.html

Chemical physicists quantitatively model electron interactions in real quantum materials

A team of scientists from Caltech and Yale University has shown for the first time how to accurately quantify an important quantum phenomenon in metals, called the Kondo effect, for specific real materials. Unlike previous approaches, which for decades have relied on simplified models to qualitatively describe the effect, the new work uses the actual atomic and electronic structures of materials to solve the problem directly.

The work represents a step toward simulations of important quantum materials such as high-temperature superconductors, in which the motions of individual electrons depend so sensitively on what other electrons are doing at any moment that they cannot be averaged together.

The team describes the new technique and results in a paper published in *Science*.

https://phys.org/news/2026-08-chemical-physicists-quantitatively-electron-interactions.html

Neutron capture experiment sheds light on ancient stardust

Niobium-94, an isotope of niobium with 41 protons and 53 neutrons, is a critical crossroads in the complex nuclear processes that forge heavy elements under the intense pressures and temperatures of dying stars. In an article published in *Physical Review Letters*, the n_TOF Collaboration reports the first-ever measurement of the probability of niobium-94 taking one of the paths at this crossroads—that is, undergoing neutron capture.

This new result provides insight into a persistent puzzle over the composition of ancient stardust. This type of stardust, known as presolar grains, survived the formation of the sun and did not get incorporated into our solar system. Some of these grains can now be found on Earth, having been brought down by primitive meteorites. Through analyzing these presolar grains, researchers can get a snapshot of the nuclear makeup of our galaxy as the heavy elements were being formed. The puzzle for researchers is that the presolar grains contain more molybdenum-94 than can be explained by theoretical models.

To investigate this problem, researchers looked at niobium-94, which is very similar to molybdenum-94 but with one less proton and one extra neutron. Within a dying star, where the extreme environment allows heavy elements to form, niobium-94 is at a crossroads. It may undergo beta decay to become molybdenum-94 or neutron capture to become niobium-95. Understanding how these two processes compete in this environment is crucial for gaining insight into why there are such mysteriously large amounts of molybdenum-94 in presolar grains.

https://phys.org/news/2026-08-neutron-capture-ancient-stardust.html

Three photons at once beat the standard photon test

Physicists at the University of Twente have improved the standard test for the quality of individual particles of light. By letting three photons interfere at the same time instead of two, they draw more information from every measurement. Their experiment outperforms even a perfect, noise-free run of the old method. The work appeared in *Physical Review Letters*.

Quantum technology based on light works only if the photons involved are as close to identical as possible. In practice, they never quite are. Laboratories therefore measure in advance how well their photons match. Since 1987, that has been done with the Hong-Ou-Mandel experiment, in which two photons meet at a beam splitter. If the two are indistinguishable, they always leave the splitter together.

"Hong-Ou-Mandel is one of the first experiments you learn about in quantum optics," says Stefan van den Hoven, Ph.D. candidate and first author of the study. "It is usually also the first benchmark that quantum researchers use for their experiments."

https://phys.org/news/2026-08-photons-standard-photon.html

Thank you!

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