



Pasqal's Neutral-Atom Processor Uncovers Quantum Magnet Behavior That Theory Did Not Predict

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With the Flatiron Institute and leading European research institutions, Pasqal used its 256-qubit processor to observe an unexpected slowdown in a 2D quantum magnet, in a regime that current theory and classical simulations cannot yet reliably predict.

Key Takeaways

- Pasqal's quantum processor has moved from reproducing known physics to revealing behavior that theory did not predict, a key step toward quantum computers becoming tools that generate new scientific insight.
- On Pasqal's 256-qubit neutral-atom processor, a 2D quantum magnet took far longer to settle after being disturbed than theory predicts.
- The behavior emerges in a regime that current theory and state-of-the-art classical simulation cannot yet reliably predict, the kind of problem where quantum processors are expected to add value.
- The team modeled the device's noise and cross-checked against exact calculations to assess the results. The preprint, with the Flatiron Institute and four European institutions, builds on an earlier work in which the same processor reproduced the behavior of a real magnetic crystal.

PARIS, Oct. 27, 2026 (GLOBE NEWSWIRE) -- Pasqal (Nasdaq: PSQL), a global leader in neutral-atom quantum computing, today announced that its 256-qubit quantum processor has revealed an unexpected behavior in a two-dimensional quantum magnet: under certain conditions, the system takes far longer to settle after being disturbed than theory predicts. The results, released as a preprint with the Flatiron Institute, the University of Augsburg, Forschungszentrum Jülich, the University of Regensburg and the Institut d'Optique–CNRS, were obtained in a regime where three state-of-the-art classical simulation methods no longer agree with one another.

A regime theory cannot yet predict

The researchers abruptly pushed the magnet out of equilibrium, a sudden change physicists call a quench and expected it to settle quickly into a new stable state, as most systems do. Under one set of conditions, it didn't. The result marks a shift in how quantum processors can be used in research: not only to reproduce what scientists already know, but to reveal behavior they did not anticipate.

The system in question is a quantum magnet: a grid of interacting atomic spins described by one of the reference models of magnetism. Models like this are deliberately simplified, but they capture behavior physicists' study across many magnetic materials, including how magnetic information spreads through a system. In two dimensions, that turns out to be remarkably hard to predict, and hardest of all once the system has been pushed out of equilibrium, where current theory offers no reliable answer.

That is precisely the regime Pasqal set out to explore, in two stages. Earlier this year, in a study released as a preprint, conducted with MagLab, Los Alamos National Laboratory and the University of Tennessee, Pasqal's 256-qubit processor reproduced the behavior of a real magnetic crystal and matched laboratory measurements with a high level of quantitative agreement, an important benchmark for using the machine as a scientific instrument.

In the new study, carried out with the Flatiron Institute, and the University of Augsburg, Forschungszentrum Jülich, the University of Regensburg, the Institut d'Optique–CNRS, the team used the same platform to go further: not to reproduce known physics, but to explore beyond it.

Three ways to settle, one unexplained

Watching a 16×16 grid of atoms relax after a sudden change, the team found the system could settle in three different ways depending on the strength of the applied field. Two were expected. The third was not: an abrupt slowdown, in which the system takes far longer to settle than theory predicts. The team says plainly that it cannot yet explain it.

That unexplained behavior appears exactly where classical computation runs out of road. Three different state-of-the-art methods were run alongside the experiment; all three track the processor at first, then peel away from the measurement, and from each other, as the complexity building inside the system outgrows what they can represent. Beyond that point, none of them can reliably describe what happens next, while the quantum processor's results stay consistent as the system grows.

Before drawing any conclusions, the team confirmed the behavior was genuine physics and not an artifact of an imperfect

machine, modeling the device's noise and cross-checking against exact calculations where those remain reliable.

A second finding broadens the platform's reach. Under a strong enough field, the magnet begins to behave like a fundamentally different kind of magnet, known as an XY-like magnet. Such systems are also studied for spin transport, the way magnetic information travels through a material, opening a wider range of physical systems to study on the same processor.

"This is what makes quantum computing so exciting: we are not simply reproducing what we already know, but uncovering behavior we did not expect," said Loïc Henriët, CTO at Pasqal. "There is still much we don't understand about quantum materials, and quantum processors can help us explore these new frontiers."

"I am really excited to see quantum computing companies and experts in classical simulation working together to understand and observe new physics. Comparing results from the quantum devices and different classical simulations and understanding where we can trust them and where we can't is extremely important. This is much more beneficial than just trying to prove quantum advantage as it leads to interesting physics results like we have here that will stand the test of time," said Joseph Tindall, Associate Research Scientist at the Flatiron Institute's Center for Computational Quantum Physics.

The findings do not constitute a demonstrated computational quantum advantage. Instead, they provide evidence of the potential for quantum processors to serve as complementary scientific tools in regimes where existing theoretical and computational methods face significant challenges.

The results are available in a preprint published on arXiv, titled "[Exploring the Relaxation Landscape of a 2D Quantum Magnet on a 256-Qubit Processor](#)". A companion blog post "[Unexpected relaxation in a 2D quantum magnet on a 256-qubit processor](#)," provides a more detailed look at the scientific findings for technical readers.

About Flatiron Institute

The Flatiron Institute is an internal division of the Simons Foundation dedicated to advancing fundamental science through computational discovery. Researchers at its Center for Computational Quantum Physics division are dedicated to developing the advanced methods necessary to address and understand the quantum many-body problem.

About Pasqal

Pasqal (Nasdaq: PSQL) helps organizations tackle problems that are difficult or impossible to solve with conventional computing methods alone. Founded in 2019 on Nobel Prize-winning research, Pasqal builds and operates neutral-atom quantum computers, delivered with a full software stack, for industry, science, and governments. Pasqal's production-ready systems are available both on-premises and through the cloud, enabling organizations to harness quantum computing without requiring in-house quantum expertise. A single hardware platform supports analog workloads today and is designed to evolve toward fault-tolerant quantum computing in the future.

Headquartered in France with operations globally, Pasqal's quantum computing systems are used by customers across energy, financial services and advanced materials to address complex challenges. Pasqal's customers include Saudi Aramco, Crédit Agricole CIB, LG Electronics and supported by partnerships with NVIDIA and IBM (Pasqal is part of the IBM Quantum Network).

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Certain statements herein may be considered "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Forward-looking statements generally are accompanied by words such as "believe," "may," "might," "will," "estimate," "continue," "anticipate," "intend," "expect," "should," "would," "could," "plan," "predict," "project," "forecast," "potential," "seem," "seek," "target," "possible," "future," "outlook" or similar terminology or expressions that predict or indicate future events or trends. These forward-looking statements include, but are not limited to, statements regarding future events, including Pasqal's ability to accelerate global deployment of its quantum computing platform.

These statements are based on current expectations and are not predictions of actual performance. They are provided for illustrative purposes only and must not be relied on as a guarantee, prediction or definitive statement of fact or probability. Actual events and circumstances are difficult or impossible to predict and are beyond the control of Pasqal. These statements are subject to known and unknown risks and uncertainties and assumptions regarding Pasqal's business, and actual results may differ materially. These risks and uncertainties include, but are not limited to: general economic, political, social and business conditions; uncertainty or changes with respect to laws and regulations; risks related to Pasqal's indebtedness; the risk from Pasqal pursuing an emerging technology, facing significant technical challenges and the potential that it may not achieve commercialization or market acceptance; Pasqal's reliance on strategic partners and other third parties; Pasqal's ability to maintain, protect and defend its intellectual property rights; and other risks that will be detailed from time to time in filings with the U.S. Securities and Exchange Commission (the "SEC"). The foregoing list of risk factors is not exhaustive. There may be additional risks that Pasqal does not know or currently believes are immaterial that could also cause actual results to differ from those contained in forward-looking statements. In addition, forward-looking statements provide Pasqal's expectations, plans and forecasts of future events and views as of the date of this communication. While Pasqal may elect to update these forward-looking statements in the future, Pasqal specifically disclaims any obligation to do so.

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