Volume 8, Issue 2
April - June 2026

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HIGHLIGHTED ARTICLES

FEATURED IN PHYSICS
Information, movement, and adaptation in human vision
Alexander J. H. Houston, David H. Brainard, Ramesh K. Sridharan, and David J. Heeger
Phys. Rev. Research 8, 021061 (2026) - Published 29 April, 2026

A model captures how the retina avoids tuning out during a fixed gaze.

EDITORS' SUGGESTION
Error detection without postselection in adaptive quantum circuits
Eli Chertkov, Andrew J. Potter, David Huse, and Michael Foss-Feig
Phys. Rev. Research 8, 021077 (2026) - Published 16 April, 2026

Correct quantum computers are noisy and require either scalable and costly error correction or error mitigation. Adaptive error detection is a hybrid approach that combines both. Researchers present a practical and cheap error detection framework that avoids postselection, which they use to simulate a nonequilibrium phase transition in an open quantum system on a trapped-ion quantum computer.

EDITORS' SUGGESTION
Trapping and cooling mechanisms in blue-detuned magneto-optical traps of molecules
Dimitis Lycarelli & Tarluci
Phys. Rev. Research 8, 021079 (2026) - Published 9 June, 2026

This work identifies the mechanisms responsible for trapping and cooling in a blue-detuned magneto-optical trap driven by a pair of closely spaced frequency components of opposite circular polarization. When the Doppler-splitting matches the frequency difference between the two components, there is a state that's dark to the light and experiences a restoring force and a damping force in the opposite direction, generating a radiation pressure force toward the field zero.

EDITORS' SUGGESTION
Dynamical phase transitions across slow and fast regimes in a two-tone driven Duffing resonator
Soumya S. Kumar, Jacob de Pina, Latacia Cavalieri, Alexander Eisner, and Gilad Zilberberg
Phys. Rev. Research 8, 021084 (2026) - Published 15 June, 2026

The dynamical phase transitions of a Duffing resonator subjected to a bichromatic drive across the slow- and fast-beating regimes are mapped. An analytical threshold to observe these transitions based on an effective nonlinear response theory is provided, explaining the mechanisms behind these processes. Complementary analytical treatments for the slow and fast regimes are supplied.

EDITORS' SUGGESTION
Experimental measurement and a physical interpretation of quantum shadow enumerators
Daniel Gottesman, Lukas Pawlas, Alex Steiner, Lennart Bittel, Gregory A.L. White, Yifan Tang, Eric J. Kuehnke, Antonio Z. Mele, Samuel Bloch, Lorenzo Leone, Jens Carrasco, Christian D. Marciniak, Sven Prepelitchi, Mihai-Gabriel Bertsch, Robert Knecht, Rainer Blatt, Philipp Schindler, Thomas Monz, Martin Kliesmann, and Martin Ostermann
Phys. Rev. Research 8, 021093 (2026) - Published 18 June, 2026

This article shows that Kuitov-quantum shadow enumerators, a powerful tool in quantum error correction, admit a direct physical interpretation in terms of outcome statistics of two-copy Bell measurements. This connection enables efficient learning protocols for these quantities and is demonstrated experimentally on a trapped-ion quantum device.

LETTERS

LETTER
First electron acceleration in a tunable-velocity laser wakefield
Xavier Lebreton, Antoni Gobbesmas, Elias Smaniotto, Anda-Maria Stăpan, Sherwy Tara, and Victor Malka
Phys. Rev. Research 8, L022017 (2026) - Published 7 April, 2026

Flying-focus wakefields promise to overcome the dephasing limit in laser-wakefield acceleration, enabling the acceleration of higher-energy electrons. Here, experimental measurements of flying-focus wakefields can reproduce the coherent structures necessary for accelerating ultrarelativistic electrons. It also shows that tuning the propagation velocity of the wakefield impacts the maximum electron energy, suggesting the partial mitigation of dephasing.

LETTER
Long nuclear spin coherence times for molecules trapped in high-purity solid parahydrogen
Alexander P. Mishkevich and Jonathan D. Weinstein
Phys. Rev. Research 8, L022020 (2026) - Published 7 April, 2026

The nuclear spin coherence of HD molecules trapped in solid hydrogen is measured. The proton coherence time increases as the magnetic impurities in the solid are reduced, until a limit from the solid itself is reached. Because of the unusual nature of solid hydrogen, long coherence times can be obtained in the solid phase without magic angle spinning.

LETTER
Direct observation of three-neutron emission from and the search for the trineutron
S. M. Wang et al.
Phys. Rev. Research 8, L022023 (2026) - Published 7 April, 2026

Three-neutron emission from the neutron-rich unbounded nucleus He is measured. The kinematic correlations between the neutrons are measured. The three-neutron invariant mass spectrum and correlations constrain the decay mechanism and the possible contribution of a trineutron component.

LETTER
Sub-kHz mechanical resonator passively cooled to 6 mK
Juan-Luis Guerrero, Jonna Pikanen, Tim M. Fuchs, Guillem, Jan de Vasconcelos, Bernhard Gerlach, Thijmen de Jong, Jasper Bilg, Wert A. Bosch, and Tjerk H. Oosterkamp
Phys. Rev. Research 8, L022024 (2026) - Published 7 April, 2026

Passive cooling of a 700 Hz resonator (1.5 mg) mechanical oscillator down to 6 mK is demonstrated. The resonator is thermally decoupled, as confirmed by detecting its thermal motion via a sub-Hz-based detection scheme. At this temperature, the thermal motion of the resonator is still clearly distinguishable from the background noise and the origin of its thermal saturation are discussed.

LETTER
Radiation-tolerant polarized solid target
Y. Ohshima, S. Sato, D. Takahashi, K. Kawagoe, K. Nakagawa, K. Peterson, Y. Maeda, T. Haigun, H. Nishikawa, S. Etsuko, K. Sakai, K. Sugahara, K. Suzuki, T. Uesaka, T. Wakasa, and A. Wakamori
Phys. Rev. Research 8, L022025 (2026) - Published 3 April, 2026

Radiation damage caused by radicals generated during high-intensity beam irradiation can be repaired through annealing. On the basis of this concept, researchers have developed a polarized proton solid target that maintains high polarization even under intense radiation polarization with photoneutron light emission.

LETTER
Realizing a topological staggered Su-Schrieffer-Heeger ladder with atomic momentum lattice
Yi-Fi Zhao, Chao Zang, Pei-Pei Ma, Yao-Jun Zhu, Tian-Yu Chen, Ken-Yang Dai, and Jian-Wei Pan
Phys. Rev. Research 8, L022026 (2026) - Published 6 April, 2026

A staggered Su-Schrieffer-Heeger ladder is realized in an atomic momentum chain by introducing fully controlled next-nearest-neighbor couplings. By leading the bulk dynamics of wave packets, the experiment maps the two-dimensional topological phase diagram of the ladder model and identifies three phases characterized by winding numbers.

LETTER
Neural wave functions for high-pressure atomic hydrogen
David Ernesto, Sandro Morosi, Giuseppe Carleo, and Markus Holzmann
Phys. Rev. Research 8, L022027 (2026) - Published 7 April, 2026

A neural quantum state wave function for high-pressure atomic hydrogen is introduced. It is optimized using variational Monte Carlo in a same variational framework, both under the Born-Oppenheimer approximation and beyond it. Using this approach, the calculated ground-state energies match or improve on established projector Monte Carlo benchmarks, and the simulations capture the change from crystalline order to a liquid-like phase under extreme compression.

LETTER
Hilbert space geometry and quantum chaos
Rozalia Ebrahimi, Anastasia Tsikalova, Alexander Gorsky, Vladimir Schaev, and Andrei Pochinskiy
Phys. Rev. Research 8, L022028 (2026) - Published 9 April, 2026

Hilbert space geometry defined by the quantum geometric tensor is analyzed for quasiperiodic dependent random matrix ensembles. The quantum metric forms a smooth manifold in the ergodic regime but develops a conical defect near integrable points.

LETTER
Coherent attosecond x-ray pulses from beam-driven relativistic plasma mirrors
M. Lamac, P. Valenta, O. Chvosujsky, J. Nejdl, T. M. Jeong, and S. J. Rosenzweig
Phys. Rev. Research 8, L022029 (2026) - Published 10 April, 2026

A nonlinear plasma wave driven by a proton or electron particle beam can form a relativistic mirror that compresses and amplifies an optical laser into a coherent attosecond x-ray pulse. By comparing the principles theory with multidimensional particle-in-cell simulations, this work identifies beam-driven relativistic plasma mirrors as a promising route for bright coherent x-ray generation.

LETTER
Bipartite entanglement measures for anyonic systems
Zhenhao Yu, Li Tian, and Cheng-Qian Qu
Phys. Rev. Research 8, L022030 (2026) - Published 10 April, 2026

Bipartite entanglement in anyonic systems, whose state spaces are shaped by fusion rules and superselection constraints, is investigated. The Rényi-entropy framework is generalized to anyonic systems. Hierarchy formalism and establishes an additive decomposition of total entanglement into conventional entanglement and anyonic charge entanglement.

LETTER
Temperature of an active nematic
Jay M Hick, Alvah Jain, and Ruben Lier
Phys. Rev. Research 8, L022031 (2026) - Published 13 April, 2026

A thermal hydrodynamic framework is developed for active nematics coupled to an environment and is used to analyze temperature dynamics near steady states. While linear temperature fluctuations remain insensitive to activity, owing to anisotropic but isotropic consumption, spontaneous flow in confined geometries generates spatially inhomogeneous temperature profiles that provide a thermal signature of activity.

LETTER
Phase separation in a mixture of proliferating and motile active matter
Łukasz Rupa, Joanna M. Miazga, Bartosz Szczesny, Martin Gueneau, Bartłomiej Waclaw, and Philip Bittihn
Phys. Rev. Research 8, L022032 (2026) - Published 13 April, 2026

In a mixture of growing and motile particles, the proliferating component can form dense clusters that exhibit persistent rearrangements into dense clusters. By constructing an effective model, researchers trace this behavior to growth-induced fluctuations and emergent attractive interactions, revealing a distinct mechanism of phase separation in mixed active matter, with potential relevance for tissues, tumors, and biofilms.

LETTER
Continuous matrix-product operators for quantum fields
Francesco Fabio and J. Ignacio Cirac
Phys. Rev. Research 8, L022033 (2026) - Published 14 April, 2026

By exploiting a Fock-like representation of matrix-product operators, this work provides an ansatz for matrix-product operators for quantum fields. The ansatz allows for explicit construction of many nontrivial families of continuous matrix-product operators and contains the set of matrix-product operators that have well-defined continuous limits.

LETTER
Interface fragmentation via horizontal vibration: A pathway to scalable monodisperse emulsification
Linfeng Pan and Anna Lee
Phys. Rev. Research 8, L022034 (2026) - Published 14 April, 2026

This work presents a method for producing size-tunable monodisperse emulsions utilizing the interfacial instability that arises near the end walls of a horizontally vibrated vessel containing two immiscible liquid layers. This approach allows for the upscaled production of monodisperse emulsions.

LETTER
Static impurity in a mesoscopic system of fermionic matter waves
Jean Polo, Nayana J. Chacali, Anna Minguzzi, Andreas Osterloh, and Luigi Amico
Phys. Rev. Research 8, L022035 (2026) - Published 15 April, 2026

A static impurity in a mesoscopic ring of SU(3) fermions in an artificial gauge field provides a controlled setting to study low-interactions, finite-size effects. The impurity induces persistent current and determines the matter-wave flow induced by the applied effective flux. The resulting competition between single-particle screening and specific collective dynamics produces distinct signatures in the density and persistent currents, including flux-fractionalization and symmetry-selective gap openings.

LETTER
Hamiltonian model for energy condensation in classical systems: Relevance to protons
Jordanka Ellinova, Sandro Gaudenzi, Elena Pedrosa, Sergey Ivanov, and Alfio La Pedrio
Phys. Rev. Research 8, L022036 (2026) - Published 15 April, 2026

This work explores energy condensation in a classical Hamiltonian system of coupled vibrational modes interacting with a thermal bath and an energy source. It shows how low-frequency modes become dynamically isolated and accumulate most of the system's energy, the robustness of this behavior beyond synthetic resonance conditions. It also discusses possible implications for vibrational energy redistribution in proteins.

LETTER
Delayed active swimmer in a velocity landscape
Oleksii Nickelsen, Alexander Eisner, Giovanni Volpe, and Frank Cichos
Phys. Rev. Research 8, L022037 (2026) - Published 22 April, 2026

Theory, simulations, and experiments on thermophoretic swimmers are presented to show that the time-delayed response of active particles to a spatially varying activity landscape produces a tunable density accumulation and a polarization inversion controlled by the competition between the response delay and the diffusion length.

LETTER
Vortex refraction and enhanced vortex velocities at tilted superconductor-normal metal interfaces
Vladimir G. Kogan and Ronald Prozorov, and Eric Cuevas-Ortiz
Phys. Rev. Research 8, L022038 (2026) - Published 27 April, 2026

Using a modified Ginz-dependent Ginzburg-Landau formulation, this work explores vortices bent across differently tilted superconductor/normal metal interfaces and identifies a refraction effect. Vortices in the superconductor, when approaching a refracted vortex core is found to develop a relative displacement in neighboring materials owing to unequal vortex velocities.

LETTER
Tailoring interaction ranges in atom arrays
T. Boixeng, C. Cherubin, T. Sagnac, and J. Schachenmayer
Phys. Rev. Research 8, L022039 (2026) - Published 30 April, 2026

The range of dipolar interactions in optical tweezer atom arrays is made tunable by strategically positioning for detuned relay atoms that act as controllable mediators of excitation exchange.

LETTER
Numerical case for identifying paired quantum Hall phases by their daughter states
Mike Hatchelor, Arjun Dey, and Donald P. Arovas
Phys. Rev. Research 8, L022040 (2026) - Published 30 April, 2026

Many candidate non-Abelian quantum Hall states are accompanied by "daughter" states, which are obtained by condensing quasiparticle fragments of the parent topological order. Using exact diagonalization and trial wave functions, researchers provide a numerical test of this parent-daughter relationship by demonstrating that the same interactions favor both states.

LETTER
Nonequilibrium thermodynamics in driven macroscopic self-assembly
Y.J. Thomson, J.M. Bomsta, and D.M. Harris
Phys. Rev. Research 8, L022041 (2026) - Published 1 May, 2026

Supercritical traveling waves are used to drive structural rearrangements of small clusters of spherical particles bound by capillary attractions. Direct measurement of transition rates between metastable cluster configurations reveals a nonzero entropy production rate reflecting broken detailed balance, in quantitative agreement with a theoretical active-matter model.

LETTER
Phase structure of below-threshold harmonics in aligned molecules: A fine-level model system
Samuel Grigoa, Lina Bielke, Fabricio Mendonca, Francisco Ferrer, and Dieter Bauer
Phys. Rev. Research 8, L022042 (2026) - Published 1 May, 2026

This work analyzes the phase and polarization structure of below-threshold harmonics from aligned molecules in linearly polarized fields. It shows that in a three-level model system, harmonics below and above the transition frequency exhibit a qualitatively different phase behavior, a feature that directly imprints on the polarization of harmonics emitted from systems with orthogonal transitions.

LETTER
Phase separation with nonlocal interactions
Pepe A. Fonseca, Yicheng Qiang, Oliver M. Pickar, and David Dean
Phys. Rev. Research 8, L022043 (2026) - Published 4 May, 2026

The interplay between phase separation and nonlocal interactions is identified as a unifying mechanism underlying the morphologies of liquid-droplets across systems ranging from living cells to clean materials and charged liquids. Identifying short- and long-range interactions as the relevant ingredients, this work shows how generic phase transitions that produce distinct droplet morphologies and their coexistence, bridging conventional phase-separation and pattern formation.

LETTER
Topological Isotopomers
Jiuan Wang
Phys. Rev. Research 8, L022044 (2026) - Published 5 May, 2026

Dark matter may consist of long-range entangled topological order, so gapped anyonic excitations may decay to generate the standard model's lepton asymmetry.

LETTER
Experimental measurement of quantum first-passage time distributions
Joseph M. Ryan, Simon Gröblacher, Thomas J. Hessler, Michael G. Prais, Stephen P. Tetlowski, and Crystal Noel
Phys. Rev. Research 8, L022045 (2026) - Published 7 May, 2026

First-passage time distributions for classical stochastic processes have been extensively studied both theoretically and experimentally. By contrast, the quantum counterpart has been theoretically explored, unexplored and carry deep implications for both fundamental physics and the development of emerging quantum technologies. This work reports single-shot projective measurements of the quantum motion of a trapped-ion subject to electric field noise using composite phase laser sequences. Such sequences act as an effective quantum filter for constructing quantum first-passage time distributions of the ion motion.

LETTER
Topology and edge modes surviving criticality in non-Hermitian Floquet systems
Longxiao Zhou
Phys. Rev. Research 8, L022046 (2026) - Published 11 May, 2026

A theoretical framework based on Cauchy's argument principle on the generalized Brillouin zone is developed to characterize gapless topological phenomena in non-Hermitian Floquet systems. Non-Hermitian systems, providing unified winding numbers, bulk-edge correspondence, and entanglement characteristics at criticality. Applying this theory to a periodically quenched Kitaev chain and Su-Schrieffer-Heeger chain reveals gapless symmetry-protected topology and robust edge modes—including modes unique to the non-Hermitian Floquet setting—up to one of phase transitions.

LETTER
Separation of the Kibble-Zurek mechanism from quantum criticality
B. Jahni and Alireza Akbari
Phys. Rev. Research 8, L022047 (2026) - Published 11 May, 2026

The emergence of Kibble-Zurek scaling is shown to be controlled by the quasiparticle modes participating in the dynamics rather than by quantum criticality alone. As a result, quench across critical points may remain effectively adiabatic, while nonchiral quenches can still exhibit conventional Kibble-Zurek scaling.

LETTER
Stochastic resetting versus thermal equilibration: Faster relaxation, different destination
Ro, Gavi Klein-Stockhai, Barak Hirshberg, and Yael Roichman
Phys. Rev. Research 8, L022048 (2026) - Published 11 May, 2026

Stochastic resetting of Brownian motion in a harmonic potential always relaxes faster than thermal equilibration, with both the relaxation speed and the resulting nonequilibrium steady state governed by a single dimensionless parameter combining the resetting rate, viscosity, and potential stiffness.

LETTER
Influence of quantum fluctuations on the spin-flop transition in hematite
Tobias Eurenauer, Imre Hagiwara, Levente Rózsa, and Ulrich Nowak
Phys. Rev. Research 8, L022050 (2026) - Published 11 May, 2026

An investigation of the spin-flop transition of a quantum spin model for hematite using different theoretical methods shows that, despite the presence of long-range order and large quantum numbers, correctly accounting for quantum fluctuations is essential to describe this phase transition accurately at low temperatures.

LETTER
Winding-control mechanism of non-Hermitian systems
Hongyu Hu and Yi Zheng
Phys. Rev. Research 8, L022051 (2026) - Published 11 May, 2026

By introducing conditional boundary conditions, a winding-control mechanism is established in non-Hermitian systems that links the spectral winding numbers, the nodal imaginary velocity, and the topological transition. This mechanism explains the emergence and collapse of specific loop-type periodic boundary condition spectra into their open boundary condition counterparts, accompanied by a composite reconstruction of the bulk zone and the generalized Brillouin zone, thereby revealing a topological transition between distinct spectral winding configurations.

LETTER
Phase transition in a mixture of proliferating and motile active matter
Łukasz Rupa, Joanna M. Miazga, Bartosz Szczesny, Martin Gueneau, Bartłomiej Waclaw, and Philip Bittihn
Phys. Rev. Research 8, L022052 (2026) - Published 13 May, 2026

In a mixture of growing and motile particles, the proliferating component can form dense clusters that exhibit persistent rearrangements into dense clusters. By constructing an effective model, researchers trace this behavior to growth-induced fluctuations and emergent attractive interactions, revealing a distinct mechanism of phase separation in mixed active matter, with potential relevance for tissues, tumors, and biofilms.

LETTER
Continuous matrix-product operators for quantum fields
Francesco Fabio and J. Ignacio Cirac
Phys. Rev. Research 8, L022053 (2026) - Published 14 May, 2026

By exploiting a Fock-like representation of matrix-product operators, this work provides an ansatz for matrix-product operators for quantum fields. The ansatz allows for explicit construction of many nontrivial families of continuous matrix-product operators and contains the set of matrix-product operators that have well-defined continuous limits.

LETTER
Coherent vibrational dynamics in molecular bond breaking: Methyl radical umbrella mode probed by femtosecond x-ray spectroscopy
Christian S. Schröder, John A. Hack, Joshua J. Edwards, Zhou Zhang, Ben Nelson, Ziqian Wang, Ken Wang, Daniel M. Neumark, and Stephen R. Leone
Phys. Rev. Research 8, L022054 (2026) - Published 21 May, 2026

This work discusses methyl iodide with a short pulse of ultraviolet light and tracks the temporal evolution of the emerging methyl radicals via their soft x-ray absorption. The "umbrella" vibrational motion of the methyl radical is observed and characterized using a quantum-mechanical model of the x-ray transition energy shift, the time dependence of the vibrational wave function and thereby the root-pause motion of the radicals is reconstructed from the experiment.

LETTER
Electric current control of helimagnetic chirality from a multidomain state in the helimagnet
Yuta Kimura, Hideyuki Masuda, Jun-Ichiro Ohe, Shuya Sakamoto, Takeshi Seki, and Yoshinori Onose
Phys. Rev. Research 8, L022056 (2026) - Published 20 May, 2026

Helimagnetic structures—magnetic textures with chirality or handedness—host a domain wall as the interface between domains with opposite chirality. This helimagnetic domain wall is revealed to be highly mobile under electric current, leading to efficient chirality control with linear current density.

LETTER
Tight bound for the total time in digital-analog quantum computation
Mikel Garcia de Andoin and Mikel Sanz
Phys. Rev. Research 8, L022057 (2026) - Published 20 May, 2026

Digital-analog quantum computing combines the flexibility of the gate-based paradigm with the robustness of analog quantum evolutions. This work shows that it can also provably speed up hard problems. This work derives a tight upper bound on the optimal circuit time that scales linearly with the number of couplings. This result enables accurate resource estimation and allows fair comparisons with alternative paradigms.

LETTER
Impossibility of quantum private queries
Esther Hänggi and Severin Winkler
Phys. Rev. Research 8, L022058 (2026) - Published 20 May, 2026

This work investigates whether quantum communication protocols allow confidential access to a remote database. It shows that any protocol that does not reveal which item is retrieved allows the user to reconstruct the entire database.

LETTER
Spinor pairing order enforced by Berry phase
Fu Liu and Ganpath R. Fiumar
Phys. Rev. Research 8, L022059 (2026) - Published 20 May, 2026

Pairing between Fermi surfaces with unequal Chern-number pairing is shown to be forbidden in time-reversal-invariant systems protected by half-integer monopole harmonics and a spinor-valued order parameter. Consequences include a single Bogoliubov Weyl node that "violates" the Nielsen-Ninomiya theorem, protected gapless surface states, and a fractional Meissner-like relation for the superfluid velocity.

LETTER
Large deviations in non-Markovian stochastic epidemics
Nayan Bansawale and Michael Assaf
Phys. Rev. Research 8, L022060 (2026) - Published 1 June, 2026

Researchers study non-Markovian epidemic models in a well-mixed setting and reveal that the nonexponential waiting-time distributions between successive infection (and/or recovery) events can significantly alter the final outbreak size distribution and disease lifetime compared with the Markovian case.

LETTER
Compact cavity-dressed Hamiltonian framework at arbitrarily strong light-matter coupling
Jakub Czartowski and Dario Poletti
Phys. Rev. Research 8, L022061 (2026) - Published 2 June, 2026

Researchers derive a nonperturbative mapping method for open quantum systems strongly coupled to a bosonic field mode and apply it to the open Dicke model and the Qubit-Mediated-Interaction model. They demonstrate advantage over conventional approaches in terms of error scaling with Hilbert space dimension and mean-field-mediated spin correlations analytically and numerically, achieving computational savings over brute-force simulations.

LETTER
Correlational transformer wave functions
Jan Chen, Vigintsah Gerasimov Naik, and Markus Heyl
Phys. Rev. Research 8, L022062 (2026) - Published 5 June, 2026

A new study introduces the correlational transformer wave function, an architecture that, unlike earlier transformer-based approaches, properly harmonizes the attention mechanism while respecting the symmetries of quantum systems, setting new accuracy benchmarks for frustrated magnets and quantum dynamics.

LETTER
Experimentally realized local-global trade-off in quantum measures
Yue Dai, Zhiyu Wang, Kerth Zhao, Xinglei Yu, and Chengjie Zhang
Phys. Rev. Research 8, L022063 (2026) - Published 5 June, 2026

The trade-off between local maximum coherence and quantum mutual information is experimentally investigated. It is found that their sum is bounded by a definitive upper limit. This result reveals a complementarity between local and global quantum resources.

LETTER
Imaginary time spectral transforms for excited-state preparation
B. A. Miller, J. W. Anderson, J. Abanovic, D. Wecker, N. Sawka, J. Kier, and S. J. Thomson
Phys. Rev. Research 8, L022064 (2026) - Published 5 June, 2026

A variational method is presented for preparing excited eigenstates of many-body quantum systems, combining a shift-invert spectral transformation with imaginary time evolution to avoid explicit matrix inversion. The approach is demonstrated on the Fermi-Hubbard model using tensor network simulations within a framework compatible with hybrid quantum-classical implementations.

LETTER
Reproducible nucleation and control of stable quantum vortex rings in Bose-Einstein condensates
Giorgia Ceri, Malgija Khare, Wen Jin Kwon, Davide Emilio Galli, and Luca Galantucci
Phys. Rev. Research 8, L022065 (2026) - Published 5 June, 2026

Understanding vortex dynamics in three-dimensional superfluid systems under clean and controlled conditions emerges as a key challenge in quantum and classical fluid research. This work introduces an experimentally feasible protocol for the on-demand nucleation and manipulation of stable quantum vortex rings in Bose-Einstein condensates. The protocol is demonstrated by systematically investigating how the protocol setup influences the ring dynamics and proposing a method to generate vortex excitations such as Kelvin waves.

LETTER
Divinyl resonant transitions in a quasiperiodic Raman lattice
Xingjie Wei, Zhenhua Yao, Tong Liu, Jian Kanhong, and Pedro Ribeiro
Phys. Rev. Research 8, L022066 (2026) - Published 9 June, 2026

Resonant transitions are investigated in a one-dimensional Raman lattice with spin-orbit coupling and a Zeeman potential containing both uniform and quasiperiodic components. A resonant critical transition with multiple entries into the critical phase is identified, extending resonant phenomena in quasiperiodic systems to include critical states. In addition to extended and localized states.

LETTER
Effects of Berry curvature on ideal fractional Chern insulator many-body gaps
Jingtian Shi, Jennifer Cano, and Nicolas Mueller-Dozier
Phys. Rev. Research 8, L022067 (2026) - Published 9 June, 2026

This work studies ideal and nearly ideal Chern bands relevant to semiconductor moiré materials. It shows how Berry curvature inhomogeneities manifest in fractional Chern insulators in terms of charge density waves, and explains this mechanism using the single-mode approximation.

LETTER
Extending the dynamic range in quantum frequency estimation with sequential weak measurements
Yu Shimizu, Masaya Kohno, and Yuichi Saito
Phys. Rev. Research 8, L022068 (2026) - Published 11 June, 2026

A sequential-weak measurement protocol is developed for Gaussian quantum frequency estimation with coherent spin states in which weakly entangled ancilla qubits track the sensing qubits during free evolution to suppress phase slip errors and extend the dynamic range. The protocol is analyzed analytically and numerically and saturates the Cramér-Rao precision bound asymptotically across a large frequency bandwidth.

LETTER
Testing the problem of time with cold atoms
Giovanni Barontini
Phys. Rev. Research 8, L022069 (2026) - Published 11 June, 2026

An ultracold atomic gas is used as a self-contained minuiverse to show it arises can be defined within an external clock. It is demonstrated that entropy exchange between different sectors of the system provides an internal time that robustly orders the dynamics and yields a Schrödinger description of the observed evolution.

LETTER
Nonstabilizerness in molecular bonding
Matthew Lewis and Alexandre Tuckmann
Phys. Rev. Research 8, L022070 (2026) - Published 11 June, 2026

Hermitic nonstabilizerness, or magic, in molecular electronic ground states along diatomic bond stretching coordinates is analyzed, for H and several other dimers, magic measures form an intermediate-separation peak near rapid changes in the bonding energy curve, providing one quantum information-theoretic insight on molecular bonding beyond entanglement.

LETTER
Visualizing phonon edge states on molybdenum disulfide
Pierre-Eliano Bouhier, Matthias Dellenbach, Diego Verzeg, and Jaydeep Sonpar
Phys. Rev. Research 8, L022071 (2026) - Published 12 June, 2026

Enhanced phonon emission from previously been observed near edges of transition metal dichalcogenide materials with high resolution transmission electron microscopy (HR-TEM). Here this observation is accounted for by localized phonon edge modes by including correlated atom-vibrations in HR-TEM image simulations.

LETTER
Current-induced successive structural phase transitions beyond thermal equilibrium in single-crystal
Shunsuke Kitou, Hirotaro Tagawa, Masaki Shimomi, Tsuge Nakamura, Yuka Kamiya, Yoko Kamiya, Taku Sasai, Kyohei Tatsuno, Shinsuke Kunimi, and Tri Tsuyoyoga
Phys. Rev. Research 8, L022072 (2026) - Published 12 June, 2026

Using synchrotron x-ray diffraction, optical microscopy, and Raman spectroscopy, current-induced structural phase transitions in single-crystal vanadium dioxide are investigated. Successive transitions to two distinct metallic nonsingular phases are observed, including a nanopolycrystalline structure with isotropic lattice expansion inaccessible under thermal equilibrium.

LETTER
Confinement and finite-range effects in a quasi-two-dimensional gas of fermionic dimers
Alessandro Milani, Jonas Bronzan, and Grigory E. Astrakharchik
Phys. Rev. Research 8, L022073 (2026) - Published 17 June, 2026

A study of a gas of fermionic dimers in a quasi-two-dimensional geometry induced by strong harmonic confinement in one direction is presented. Fixed-node diffusion Monte Carlo calculations are used to quantify the effects of confinement and finite interaction range on the ground-state energy profiles, with the results benchmarked against analytical theories.

LETTER
Coherent vibrational dynamics in molecular bond breaking: Methyl radical umbrella mode probed by femtosecond x-ray spectroscopy
Christian S. Schröder, John A. Hack, Joshua J. Edwards, Zhou Zhang, Ben Nelson, Ziqian Wang, Ken Wang, Daniel M. Neumark, and Stephen R. Leone
Phys. Rev. Research 8, L022054 (2026) - Published 21 May, 2026