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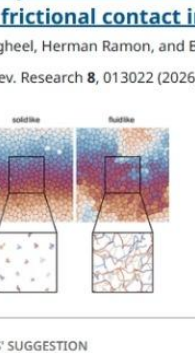
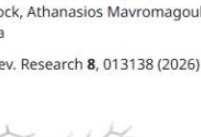
HIGHLIGHTED ARTICLES

EDITORS' SUGGESTION
Rigidity transitions in a three-dimensional active foam model of cell monolayers with frictional contact interactions
Jef Vangheel, Herman Ramon, and Bart Smeets
Phys. Rev. Research **8**, 013022 (2026) - Published 12 January, 2026


Rigidity transitions play key roles in epithelial dynamics during development and disease. This study applies a three-dimensional active foam model to quantify how adhesion, cell activity, and intercellular friction govern fluid-to-solid behavior, revealing distinct deformation- and debonding-based regimes.

EDITORS' SUGGESTION
Molecular spin qudits to test generalized Bell inequalities
Silvia Macedonio, Luca Lepori, Alessandro Chiesa, Simone Chicco, Laura Bersani, Marcos Rubín-Osanz, Lukas Bradley Woodcock, Athanasios Mavromagoulos, Giuseppe Allodi, Elena Garlatti, Stergios Piligkos, Augusto Smerzi, and Stefano Carretta
Phys. Rev. Research **8**, 013138 (2026) - Published 9 February, 2026


This work studies generalized Bell inequalities in molecular spin qudits, focusing on qubit-qudit and qudit-qudit systems. Numerical simulations using experimentally measured parameters on an a Yb(trensal) molecule, featuring a nuclear spin qudit coupled to an electronic spin qubit, demonstrate that violations of Bell inequalities can be achieved with realistic control protocols and decoherence times.

EDITORS' SUGGESTION
Modulation of superconducting properties by the charge density wave at the surface of $2H\text{−}\mathrm{NbSe}_2$
T. Hanaguri
Phys. Rev. Research **8**, 013164 (2026) - Published 12 February, 2026

Using ultralow-temperature scanning tunneling microscopy, this work provides a benchmark spectroscopic-imaging dataset for $2H$-NbSe$_2$ and reveals how the charge density wave and surface-induced in-plane broken inversion symmetry influence the superconducting properties.

EDITORS' SUGGESTION
Coupled dimerized alternating-bond quantum spin chains in the distorted honeycomb-lattice magnet $\mathrm{Cu}_5\,\mathrm{SbO}_6$
C. Piyakulworawat, K. Morita, Y. Fukumoto, W.-Y. Hsieh, W.-T. Chen, K. Nakajima, S. Ohira-Kawamura, Y. Zhao, S. Wannapaiboon, P. Piyawongwatthana, T. J. Sato, and K. Matan
Phys. Rev. Research **8**, 013247 (2026) - Published 6 March, 2026

Research on Cu$_5$SbO$_6$, a material in which Cu^{2+} ions are arranged in distorted honeycomb lattices, reveals a magnetic scheme of interacting ferromagnetic-antiferromagnetic quantum spin chains residing in the honeycomb layers. Unlike similar materials, the interchain interaction in this compound is dominated by the interlayer antiferromagnetic coupling rather than the intralayer coupling.

EDITORS' SUGGESTION
Dynamical arrest in active nematic turbulence
Ido Lavi, Ricard Alert, Jean-François Joanny, and Jaume Casademunt
Phys. Rev. Research **8**, 013294 (2026) - Published 17 March, 2026

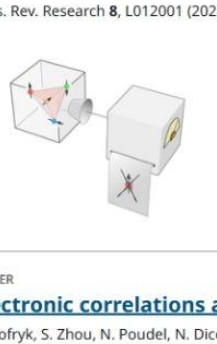
Active nematic fluids have been widely studied in regimes teeming with topological defects. But what emerges in their absence? Simulations show that the flow-alignment coupling promotes a striking arrested state, with coherent streams funneled through a treelike network of nematic domain walls; as the nematic healing length increases, defects unbind along these walls and unravel the arrested network.

LETTERS

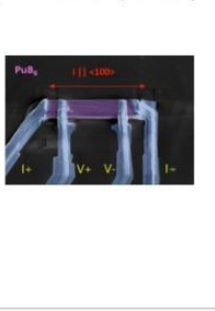
LETTER
Quantum state exclusion for group-generated ensembles of pure states
A. Diebra, S. Llorens, E. Bagan, G. Sentís, and R. Muñoz-Tapia
Phys. Rev. Research **8**, L012001 (2026) - Published 2 January, 2026

A complete optimal solution to quantum state exclusion is provided for pure states generated by the action of any linear or projective representation of a finite group, covering both perfect and imperfect exclusion. Closed-form expressions are derived for the optimal measurements and the corresponding failure probabilities in both minimum-error and unambiguous exclusion protocols.

LETTER
Electronic correlations and topology in Kondo insulator
K. Gofryk, S. Zhou, N. Poudel, N. Dice, D. Murray, T. Pavlov, and C. Marianetti
Phys. Rev. Research **8**, L012002 (2026) - Published 5 January, 2026

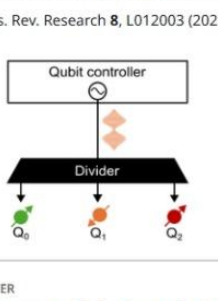

Using a combination of plasma focused ion beam micromachining, low-temperature magnetotransport measurements, and first-principles calculations, this study demonstrates that PuB exhibits hallmark characteristics of a topological Kondo insulator, including a transition in electrical resistivity from high-temperature thermally activated behavior, indicative of a narrow gap at the Fermi level, to a distinctive low-temperature resistivity plateau. Furthermore, the observed surface-to-volume dependence of resistivity at low temperatures provides evidence for the presence of topologically protected surface states.

LETTER
Selective excitation of superconducting qubits with a shared control line through pulse shaping
R. Matsuda, R. Ohira, T. Sumida, H. Shiomi, A. Machino, S. Morisaka, K. Koike, T. Miyoshi, Y. Kurimoto, Y. Sugita, Y. Ito, Y. Suzuki, P. A. Spring, S. Wang, S. Tamate, Y. Tabuchi, Y. Nakamura, K. Ogawa, and M. Negoro
Phys. Rev. Research **8**, L012003 (2026) - Published 6 January, 2026

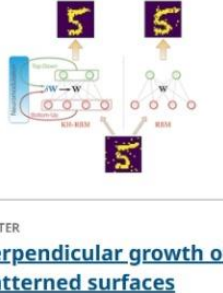


Scalable quantum processors benefit from control architectures in which multiple qubits share a single drive line, but such configurations typically require frequency separations exceeding the pulse bandwidth. A pulse-shaping technique is shown to enable selective excitation of a target qubit even when the resonance frequencies of the qubits are close to the pulse bandwidth.

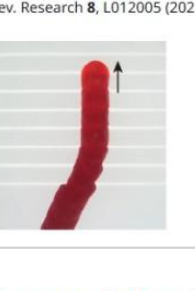
LETTER
Neuromodulation via Krotov-Hopfield improves accuracy and robustness of restricted Boltzmann machines
Başer Tambaş, A. Levent Subaşı, and Alkan Kabakçıoğlu
Phys. Rev. Research **8**, L012004 (2026) - Published 7 January, 2026


Neuromodulation offers a cost-effective pathway to more expressive neural networks, realized here by employing the Krotov-Hopfield algorithm as a global neuromodulatory signal within restricted Boltzmann machines (RBMs). By inducing intralayer competition between the RBM units through selective synaptic inhibition, this mechanism yields superior reconstruction and classification accuracy, as well as increased robustness to overfitting and weight initialization.

LETTER
Perpendicular growth of a tip-growing polymer precipitate on parallel line-patterned surfaces
Chan Jin Park, Hyobin Jeon, Yun Kyung Choi, Ji Seon Kim, Young Woon Lim, and Ho-Young Kim
Phys. Rev. Research **8**, L012005 (2026) - Published 7 January, 2026


Tip-growing polymer precipitates on grooved surfaces reorient to grow perpendicular to the patterns, a behavior that arises because the advancing tip becomes partially constrained by the surface topography.

LETTER
Continuous variable entanglement in a cold-atom mirrorless optical parametric oscillator
G. C. Borba, R. S. N. Moreira, L. S. Cruz, M. Martinelli, D. Felinto, and J. W. R. Tabosa
Phys. Rev. Research **8**, L012006 (2026) - Published 9 January, 2026


Internal and external degrees of freedom of a sample of cold cesium atoms are explored to observe quadripartite entanglement between optical modes produced by a mirrorless optical parametric oscillator excited in the medium. This observation opens a new route to generate multipartite continuous-variable entanglement from cold atoms.

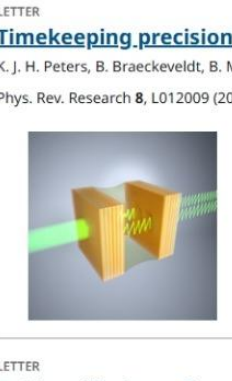
LETTER
Environment-induced transitions in many-body quantum teleportation
Shuyan Zhou, Pengfei Zhang, and Zhenhua Yu
Phys. Rev. Research **8**, L012007 (2026) - Published 12 January, 2026

Many-body quantum teleportation in the presence of environments is investigated. Using a generic argument harnessing the relationship between many-body quantum teleportation and information scrambling, corroborated by explicit demonstration in solvable Brownian Sachdev-Ye-Kitaev models, two emergent critical points are predicted that hallmark the transitions of the teleportation performance from the quantum regime to the classical regime and finally to the no-signal regime as the system-environment coupling increases.

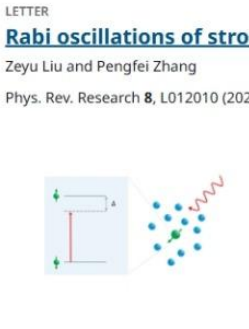
LETTER
Steady state of periodically driven quantum systems
Milan Šindelka and David Gelbwaser-Klimovsky
Phys. Rev. Research **8**, L012008 (2026) - Published 12 January, 2026

Periodic driving is used to steer physical systems to unique steady states. Characterizing the steady state is challenging, and existing results are generally limited to specific types of driving, such as high frequency. This work goes beyond this, deriving general thermalization conditions that constrain the nature of the steady state and the transition rates. Moreover, it is found that the steady state at high enough temperatures is a thermal state for any driving.

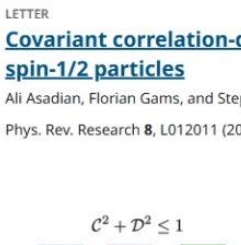
LETTER
Timekeeping precision enhancements at constant power
K. J. H. Peters, B. Braeckeveldt, B. Maes, and S. R. K. Rodriguez
Phys. Rev. Research **8**, L012009 (2026) - Published 12 January, 2026


The precision of a noisy clock embodied in the limit cycle oscillations of a laser-driven optical cavity is studied. By adjusting the optical cavity length, which in turn influences the limit cycle fluctuations, timekeeping precision enhancements at constant laser power are realized, regardless of the clock's frequency.

LETTER
Rabi oscillations of strongly driven Bose polarons
Zeyu Liu and Pengfei Zhang
Phys. Rev. Research **8**, L012010 (2026) - Published 12 January, 2026

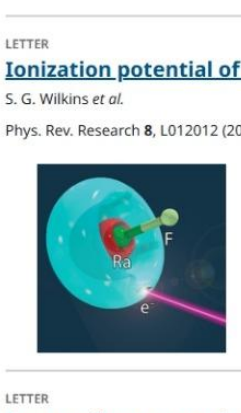

A trial wavefunction approach is employed to investigate the dynamics of Bose polarons in the presence of strong Rabi coupling. Analytical results are obtained when the majority of atoms are noninteracting, enabling a description of the dynamical evolution for arbitrarily long times.

LETTER
Covariant correlation-disturbance relation and its experimental realization with spin-1/2 particles
Ali Asadian, Florian Gams, and Stephan Sponar
Phys. Rev. Research **8**, L012011 (2026) - Published 13 January, 2026



An optimal quantum trade-off relation is formulated between measurement disturbance (D) and temporal correlations (C) for arbitrary sequential quantum measurements, enabling efficient characterizations of the device's quantum operations.

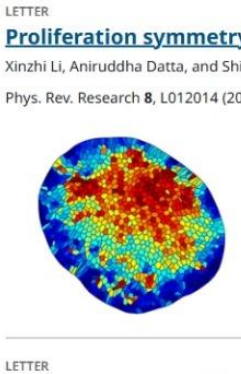
LETTER
Ionization potential of radium monofluoride
S. G. Wilkins *et al.*
Phys. Rev. Research **8**, L012012 (2026) - Published 13 January, 2026


The ionization potential of radium monofluoride (RaF) was experimentally determined in agreement with predictions from theory, showing that its dissociation energy is greater than the energy required to remove an electron. This electronic structure places RaF in a group of molecules that possess long-lived Rydberg states that are stable against predissociation.

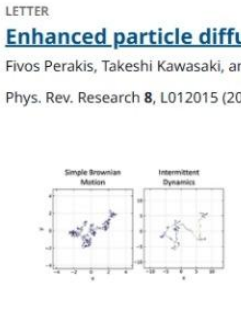
LETTER
Superradiant scattering from evanescent waves
M. Pardal, R. A. Fonseca, and J. Vieira
Phys. Rev. Research **8**, L012013 (2026) - Published 14 January, 2026

If an electron beam collides with an evanescent mode in a plane, then the beam will radiate collectively as a virtual particle whose position is defined by the beam-plane intersection. This work shows that, under certain conditions, this virtual light source can be superluminal, leading to the formation of Cherenkov-like optical shocks, and demonstrates how an electron beam shaped like a twisted spiral leads to the creation of wormlike radiation patterns at a flat detector.

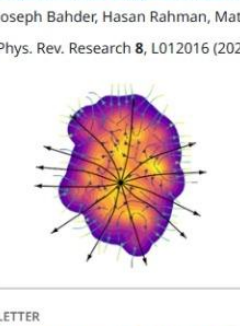
LETTER
Proliferation symmetry breaking in growing tissues
Xinzhi Li, Aniruddha Datta, and Shiladitya Banerjee
Phys. Rev. Research **8**, L012014 (2026) - Published 14 January, 2026


A self-organized model of anisotropic tissue growth driven by mechanical feedback between cell polarity, mechanical pressure, and cell division rates is presented. The study demonstrates how cell-polarity alignment generates an anisotropic distribution of mechanical pressure, which subsequently breaks symmetry in cell proliferation patterns, leading to anisotropic tissue growth.

LETTER
Enhanced particle diffusion in fluctuating binary environments
Pavlos Perakis, Takeshi Kawasaki, and Shinji Saito
Phys. Rev. Research **8**, L012015 (2026) - Published 15 January, 2026


This work examines diffusion in a Langevin model with fluctuating friction and quantifies how switching timescales influences transport and relaxation behavior.

LETTER
Signatures of jet drift in quark-gluon plasma hard-probe observables
Joseph Bahder, Hasan Rahman, Matthew D. Sievert, and Ivan Vitev
Phys. Rev. Research **8**, L012016 (2026) - Published 16 January, 2026


The impact of sub-eikonal, collective-flow-induced asymmetric jet broadening (jet drift) on hard-probe observables is studied in event-by-event = 5.02 TeV PbPb collisions at the Large Hadron Collider utilizing the new Anisotropic Parton Evolution computational framework. It is shown that jet drift imparts an enhancement of elliptic flow () and increases the mean anisotropy for low- and intermediate-energy particles (< 10 GeV).

LETTER
Agentic artificial intelligence for multistage physics experiments at a large-scale user facility particle accelerator
Thorsten Hellert, Drew Bertwistle, Simon C. Leemann, Antonin Sulc, and Marco Venturini
Phys. Rev. Research **8**, L012017 (2026) - Published 16 January, 2026

A language-model-driven agentic system at the Advanced Light Source enables multistage accelerator physics experiments to be executed from natural language prompts. The work demonstrates how such an interface can carry out complex experimental procedures on a production particle accelerator while adhering to established operational constraints.

LETTER
Entanglement transitions in a boundary-driven open quantum many-body system
Darvin Wanisch, Nora Reinić, Daniel Jaschke, Simone Montangero, and Pietro Silvi
Phys. Rev. Research **8**, L012018 (2026) - Published 20 January, 2026

A numerical framework for simulating Markovian open-system dynamics using tree tensor operator states is presented, enabling direct evaluation of entanglement monotones in both transient and steady-state regimes. By applying this approach to a boundary-driven XXZ spin chain, the work identifies how environmental coupling and anisotropy shape entanglement scaling and its relation to spin current behavior.

LETTER
Experimental evidence for invariant solutions mediating transitions from metastable turbulent regimes
B. Vishnu Kiran, Rajesh Kashyap, and Balachandra Suri
Phys. Rev. Research **8**, L012019 (2026) - Published 22 January, 2026

This study shows that characteristic flow patterns appearing immediately before and during seemingly random transitions between metastable turbulent regimes are signatures of unstable invariant solutions—equilibria or time-periodic orbits—of the equations governing fluid motion. By recognizing turbulence approaching these solutions as a precursor to imminent transitions, a closed-loop control strategy is developed and deployed in laboratory experiments to suppress transitions from metastable turbulent regimes.

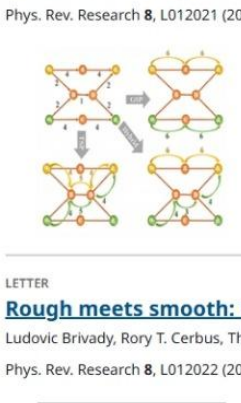
LETTER
Noise-induced maximization of integrated information in FitzHugh-Nagumo networks
Zongkun Li and Alexey Zaikin
Phys. Rev. Research **8**, L012020 (2026) - Published 22 January, 2026

This work demonstrates that noise can maximize integrated information in small-scale FitzHugh-Nagumo neural networks and the maximum exists up to a certain level in the excitable regime.

LETTER
Routing-induced phase transitions in traffic efficiency of non-Markovian dynamics
Jie Chen, Maobin Hu, Ming Li, Fudong Chen, and Jinde Cao
Phys. Rev. Research **8**, L012021 (2026) - Published 22 January, 2026

Transport on complex networks is examined using a non-Markovian traffic dynamics with congestion-dependent link travel times. The results identify fast-is-fast, slow-is-fast, and Parrondo-like efficiency regimes controlled by routing preferences.

LETTER
Rough meets smooth: Unifying granular landslide speed and runout
Ludovic Brivady, Rory T. Cerbus, Thierry Faug, and Hamid Kellay
Phys. Rev. Research **8**, L012022 (2026) - Published 23 January, 2026



The dependence of landslide runout on substrate roughness can be mapped onto the variation of the dynamic friction coefficient with the substrate roughness. This result yields additional clues to incorporate basal friction in landslide runout prediction.

LETTER
Sokoban random walk: From environment reshaping to trapping crossover
Prashant Singh, David A. Kessler, and Eli Barkai
Phys. Rev. Research **8**, L012023 (2026) - Published 26 January, 2026

A Sokoban-like active particle reshapes its disordered environment by pushing obstacles, dynamically creating transport lanes, and modifying classic paradigms such as the ant-in-the-labyrinth problem. This work uncovers a self-trapping mechanism in which the particle generates its own cages, leading to localization even at low obstacle densities and explaining the absence of a percolation transition.

LETTER
Defect-driven incoherent skin localization
Emmanouil T. Kokkinakis, Konstantinos G. Makris, and Eleftherios N. Economou
Phys. Rev. Research **8**, L012024 (2026) - Published 26 January, 2026

Wave propagation in non-Hermitian lattices under dephasing is studied, and lossy defects are shown to give rise to a dynamical non-Hermitian skin effect characterized by boundary accumulation of optical intensity, even in lattices with reciprocal couplings. Further analysis demonstrates how this defect-driven skin localization competes with the incoherent non-Hermitian skin effect arising from asymmetric hopping.

LETTER
From pure to mixed: Altermagnets as intrinsic symmetry-breaking indicators
Aline Ramires
Phys. Rev. Research **8**, L012025 (2026) - Published 26 January, 2026

Superconductivity-induced symmetry-breaking conditions for the transmutation of altermagnets from pure to mixed is investigated. Based on this analysis, scenarios are put forward that could explain the apparent onset of time-reversal symmetry breaking at the superconducting critical temperature in SrRuO and the hidden magnetic phase and magnetic memory in 4Hb-TaS.

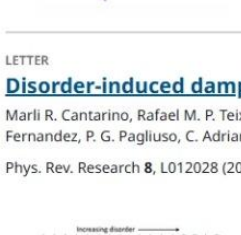
LETTER
Accelerated state expansion of a nanoparticle in a dark inverted potential
Grégoire F. M. Tomassi, Daniël Veldhuizen, Bruno Melo, Davide Candoli, Andreu Riera-Campeny, Oriol Romero-Isart, Nadine Meyer, and Romain Quidant
Phys. Rev. Research **8**, L012026 (2026) - Published 26 January, 2026

By subjecting a 125 nm silica nanoparticle to an inverted dark potential, this study demonstrates exponentially fast delocalization of a massive particle's center-of-mass thermal state. A 952-fold expansion is achieved within 260 μs, reaching a position uncertainty of 43.4 nm, a scale comparable to the particle's physical size.

LETTER
How flagellated bacteria wobble
Chen Gui, Mingxin Mao, Pu Feng, Yuxin Shen, Xiangjun Gong, Gerhard Gompper, and Jinglei Hu
Phys. Rev. Research **8**, L012027 (2026) - Published 28 January, 2026

precession
nutation
body long axis
swimming axis
Through hydrodynamics simulations of a mechanical model in polymer fluids with varying flagellar anchoring configurations, the wobbling motion of flagellated bacteria is elucidated. The analysis of the three components of wobbling (precession, nutation, and spin) challenges the common assumption that peritrichous bacteria undergo complete cycles of body spin.

LETTER
Disorder-induced damping of spin excitations in Cr-doped
Mark R. Cantarino, Rafael M. P. Teixeira, K. R. Pakuszewski, Wagner R. da Silva Neto, Juliana G. de Abrantes, Mirian Garcia-Fernandez, P. G. Pagliuso, C. Adriano, Claude Monney, Thorsten Schmitt, Eric C. Andrade, and Fernando A. Garcia
Phys. Rev. Research **8**, L012028 (2026) - Published 2 February, 2026


A combined experimental and theoretical study of Cr-doped BaFeAs reveals that substitutional disorder dominates over charge doping in the evolution of spin excitations in this Hund's metal.

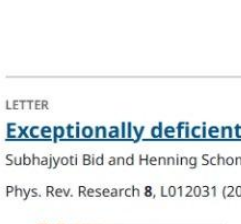
LETTER
Complete asymptotic type-token relationship for growing complex systems with inverse power-law count rankings
Pablo Rosillo-Rodes, Laurent Hébert-Dufresne, and Peter Sheridan Dodds
Phys. Rev. Research **8**, L012029 (2026) - Published 2 February, 2026

A deterministic model is proposed to describe the exact asymptotics of the type-token relationship in growing systems with power-law rankings, that is, how the number of unique elements grows as the system incorporates new elements. The resulting expression captures large system behavior across all scaling regimes and offers a more accurate fit than previous approximations.

LETTER
Social hierarchy shapes foraging decisions
Lisa Blum Moyse and Ahmed El Hady
Phys. Rev. Research **8**, L012030 (2026) - Published 2 February, 2026

Follower-leader dynamics are found, through observations of leader movements or through counting the number of individuals in a patch, to confer, for most conditions, a benefit for the following individuals by increasing their accuracy in inferring patch richness. On the other hand, misinformation, through the communication of false beliefs about food rewards or patch quality, shows to be detrimental to following individuals but paradoxically leads to increased group cohesion.

LETTER
Exceptionally deficient topological square-root insulators
Subhajyoti Bid and Henning Schomerus
Phys. Rev. Research **8**, L012031 (2026) - Published 3 February, 2026



Exceptional points accentuate the non-Hermitian characteristics of open systems. This work introduces a systematic design principle for exceptionally deficient topological phases, in which every eigenstate is stabilized at an exceptional point and identifies the dynamical signatures for a non Hermitian quadrupole insulator exhibiting robust corner states.

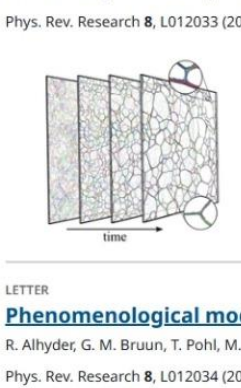
LETTER
Frustration-driven correlated parent states in the spinel superconductor
Yuita Fujisawa, Anjana Krishnadas, Chia-Hsiu Hsu, Takahito Takeda, Sheng Liu, Markel Pardo-Almanza, Yukiko Obata, Dyon van Dinter, Tomonori Nakamura, Kohei Yamagami, Guoqing Chang, Masaki Kobayashi, Chang-Yang Kuo, and Yoshinori Okada
Phys. Rev. Research **8**, L012032 (2026) - Published 4 February, 2026

This work proposes that the spinel superconductor LiTiO (3d) exhibits Ti/Ti charge disproportionation, leading to charge frustration and the enhanced intersite Coulomb interactions below * (~150 K). The associated negative thermal expansion and the appearance of a dispersion kink near the Fermi level below * serve as hallmarks of a high-entropy frustrated parent state that gives rise to superconductivity at low temperatures (~ 12 K).

LETTER
Foamlike properties in networks of bundled semiflexible polymers
Lukas P. Weise, Tobias A. Kampmann, and Jan Kierfeld
Phys. Rev. Research **8**, L012033 (2026) - Published 5 February, 2026

Large-scale simulations of mutually attractive semiflexible polymers show that they generically form a network of bundles, which slowly coarsens over time. Similar to foams, the coarsening process is driven by a reduction of the bundle surface suggesting that such structures are frequently observed in cytoskeletal systems because they represent long-lived intermediate structures in a slow coarsening process toward a ground state consisting of a single bundle.

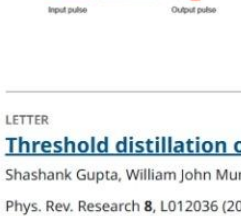
LETTER
Phenomenological model of decaying Bose polarons
R. Alhyder, G. M. Bruun, T. Pohl, M. Lemeshko, and A. G. Volosniev
Phys. Rev. Research **8**, L012034 (2026) - Published 6 February, 2026


This work studies the decay properties of Bose polarons and shows that the states probed in current experiments correspond to short-lived excited configurations rather than stable quasiparticles. A minimal theoretical description incorporating finite lifetimes is demonstrated to account for observed spectroscopic and time-domain measurements.

LETTER
Spectral compression and frequency shifts of single photons by cascade modulation
Xiang You
Phys. Rev. Research **8**, L012035 (2026) - Published 10 February, 2026

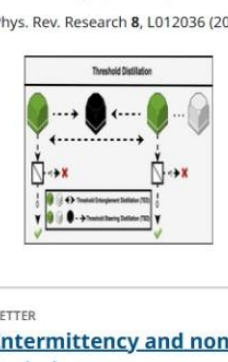
Spectral modulation of single photons is an essential quantum technology for implementing quantum interconnects. This study reports a scalable scheme to compress the spectral linewidth of single photons based on side-end cavity and time-dependent phase modulation, and the cascade technique significantly improves the compression efficiency of single-photon spectrum.

LETTER
Threshold distillation of multipartite quantum correlations
Shashank Gupta, William John Munro, and Carlos Cid
Phys. Rev. Research **8**, L012036 (2026) - Published 10 February, 2026

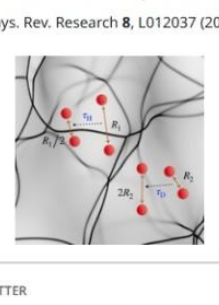


Distillation of multipartite quantum correlations usually demands coordinated operations by all parties sharing the state. This work shows that perfect multipartite states can be distilled using only a subset of parties: one party for Greenberger-Horne-Zeilinger states and all but one for states. The exact local filtering operations are derived, and the protocol's performance is characterized by analytical expressions for the success probability and output fidelity, supported by numerical simulations.

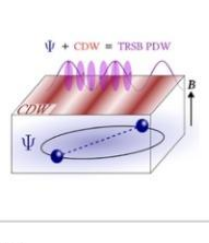
LETTER
Intermittency and nonuniversality of pair dispersion in isothermal compressible turbulence
Sadhitro De, Dhrubaditya Mitra, and Rahul Pandit
Phys. Rev. Research **8**, L012037 (2026) - Published 11 February, 2026


Richardson's law, one of the pillars of turbulence research, states that in incompressible turbulence the average of the square of the distance between two passive tracers grows as a cube of time. This work shows how to generalize this result to compressible turbulence.

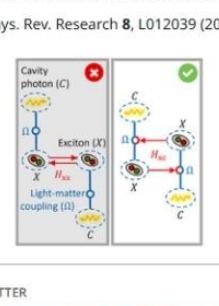
LETTER
Intertwining bulk and surface: The case of
András L. Szabó and Aline Ramires
Phys. Rev. Research **8**, L012038 (2026) - Published 11 February, 2026


Motivated by recent experimental findings in UTe, this work presents a phenomenological framework in which surface charge- and pair-density-wave orders are intertwined by bulk superconductivity. This approach naturally explains a range of surface-sensitive observations, including a magnetic-field-sensitive charge-density wave, asymmetric Fourier peak intensities, and time-reversal symmetry breaking with the onset of bulk superconductivity.

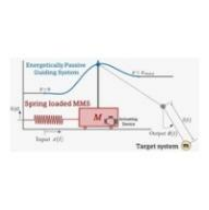
LETTER
Excitonic oscillator-strength saturation dominates polariton-polariton interactions
Maxime Richard, Irénée Frérot, Sylvain Ravets, Jacqueline Bloch, Carlos Anton-Solanas, Ferdinand Claude, Yueguang Zhou, Martina Morassi, Aristide Lemaître, Jacopo Carusotto, and Anna Minguzzi
Phys. Rev. Research **8**, L012039 (2026) - Published 17 February, 2026


The microscopic origin of the interaction between exciton-polaritons is investigated. By measuring the spectral function of the interaction-induced fluctuations around a coherently driven polaritonic field and comparing with the theory, it is found that within a typical and sizeable parameter range, the interaction is dominantly governed by a saturation mechanism of the oscillator strength and not by the scattering of the polariton excitonic fraction.

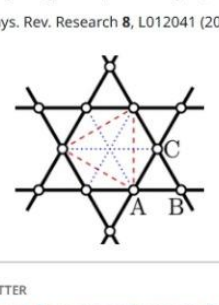
LETTER
Energetically efficient, mediated mechanical system for precise control of hoisting operations
Mikel Palmero, Juan Gonzalo Muga, and Ander Tobalina
Phys. Rev. Research **8**, L012040 (2026) - Published 20 February, 2026


A precise control protocol for hoisting a load quickly while avoiding gaining any undesired excitation energy is introduced. This protocol is implemented through a massive harmonic oscillator, which recycles most of the kinetic energy, and an energetically passive guiding system, which modulates the length of the rope to translate the harmonic motion into the designed protocol.

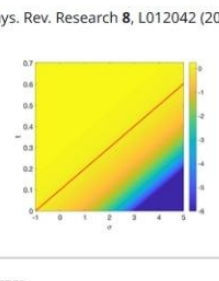
LETTER
Hall effect in topologically trivial isolated flat-band systems
Raigo Nagashima, Masao Ogata, and Naoto Tsuji
Phys. Rev. Research **8**, L012041 (2026) - Published 23 February, 2026


A fully quantum mechanical gauge-invariant formula for the Hall conductivity is established that is applicable to any noninteracting lattice models. The formula is applied to topologically trivial isolated flat-band systems, leading to a nonvanishing Hall conductivity arising from non-Abelian quantum geometric effects.

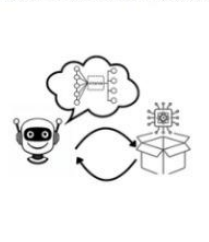
LETTER
Decoherence from universal tomographic measurements
Dorje C. Brody and Rishindra Melanathuru
Phys. Rev. Research **8**, L012042 (2026) - Published 23 February, 2026


The transition from quantum to classical is often captured in the language of decoherence, whereby the environment monitors a preferred observable of the system, leading to loss of quantum coherence. But if the environment monitors the physical state of the system, not just one observable, then the resulting decoherence effect looks quite different, and it can be shown that larger quantum systems generally decohere faster.

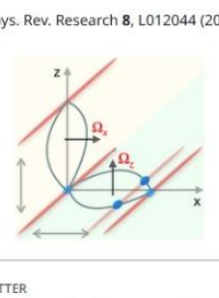
LETTER
Quantum feedback control with a transformer neural network architecture
Pranav Vaidhyanathan, Florian Marquardt, Mark T. Mitchison, and Natalia Ares
Phys. Rev. Research **8**, L012043 (2026) - Published 24 February, 2026


An attention-based transformer architecture is introduced for closed-loop quantum feedback control of continuously measured open systems, trained via supervised and reinforcement learning. The framework predicts control parameters directly from measurement records and initial states, enabling state stabilization in two-level systems, control of non-Markovian dynamics through reaction-coordinate embeddings, and approximate ground-state preparation in nonintegrable many-body systems.

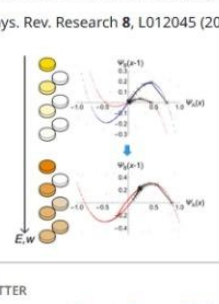
LETTER
Multiloop and multiaxis atomtronic Sagnac interferometry
Saurabh Pandey, Ceren Uzun, Katarzyna A. Krzyzanowska, and Malcolm G. Boshier
Phys. Rev. Research **8**, L012044 (2026) - Published 24 February, 2026


Atomic matter waves are coherently split, reflected, and recombined in a 1D laser waveguide to realize a large-area interferometer. The same atomic wave packets go through each other multiple times to enable large-area operation. Coherence is preserved up to five loops. This study presents multiaxis operation of the device without compromising the performance.

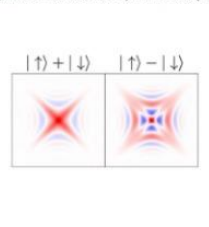
LETTER
Topological-to-topological transition induced by on-site nonlinearity in a one-dimensional topological insulator
Kazuki Sone and Yasuhiro Hatsugai
Phys. Rev. Research **8**, L012045 (2026) - Published 24 February, 2026


Uniform on-site nonlinearity induces transitions of topological edge modes from decaying to extended ones. The nonlinear extension of a transfer matrix reveals their close relationship to the bifurcations in spatial dynamics governed by the nonlinear transfer matrix.

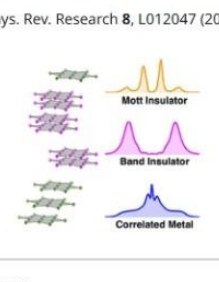
LETTER
Preparation of conditionally squeezed states in qubit-oscillator systems
Marius K. Hope, Jonas Lidal, and Francesco Massel
Phys. Rev. Research **8**, L012046 (2026) - Published 26 February, 2026


A protocol is proposed for preparing superpositions of orthogonally squeezed vacuum states in an oscillator with a quadratic coupling to a qubit. The error-correcting properties of a bosonic code based on the symmetric and antisymmetric superposition states are analyzed.

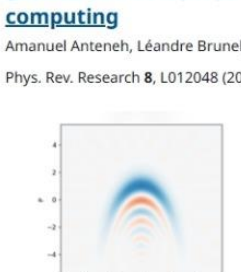
LETTER
Interlayer stacking controls the electronic properties of the van der Waals material
Nelson Hua, Francesco Petocchi, Henry G. Bell, Gabriel Aeppli, Philipp Werner, and Simon Gerber
Phys. Rev. Research **8**, L012047 (2026) - Published 2 March, 2026


The interlayer stacking structures of the various charge-density-wave phases in 1T-TaS are determined using the Hendricks-Teller formalism and validated with x-ray diffraction data. In the commensurate phase, a disordered stacking of dimers and monolayers modulates the electronic band structure, resulting in the coexistence of correlated metallic, band-insulating, and Mott-insulating layers.

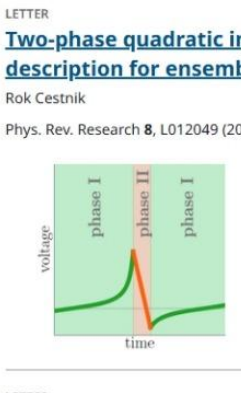
LETTER
Deep reinforcement learning for near-deterministic preparation of cubic-phase gates and direct preparation of quartic-phase gates in photonic quantum computing
Amanuel Anteneh, Léandre Brunel, Carlos González-Arciniegas, and Olivier Pfister
Phys. Rev. Research **8**, L012048 (2026) - Published 2 March, 2026


This work presents numerical simulations of deep reinforcement learning applied to controlling a simple measurement-based quantum circuit that leverages quantum interference in phase space to prepare strongly cubic gate precursors with a high success rate.

LETTER
Two-phase quadratic integrate-and-fire neurons: Exact low-dimensional description for ensembles of finite-voltage neurons
Rok Cestnik
Phys. Rev. Research **8**, L012049 (2026) - Published 2 March, 2026


A two-phase quadratic integrate-and-fire neuron model is introduced that produces realistic spike waveforms with finite continuous membrane potentials. Ensembles of such neurons retain an exact low-dimensional description consistent with established quadratic integrate-and-fire frameworks.

LETTER
Transport-generated signals uncover geometric features of evolving branched structures
Fabian H. Kreten, Ludger Santen, and Reza Shaebani
Phys. Rev. Research **8**, L012051 (2026) - Published 3 March, 2026


A noninvasive framework is introduced to recover global geometric features of branched structures by analyzing time-resolved signals generated by tracers at a single observation site. This eliminates the need to track individual trajectories and offers a diagnostic tool for inaccessible or time-evolving structures.

LETTER
Nonlinear spectroscopy as a magnon breakdown diagnosis and its efficient simulation
David A. S. Kaib, Marius Möller, and Roser Valentí
Phys. Rev. Research **8**, L012052 (2026) - Published 5 March, 2026

A Lanczos-based method is developed to simulate two-dimensional coherent spectroscopy responses directly in the frequency domain. Applied to an extended Kitaev model relevant to -RuCl, the results delineate regimes where the nonlinear response follows the universal linear-spin-wave form of the partially polarized phase and regimes where it does not, providing a spectroscopic signature of magnon breakdown.

LETTER
Evaluating the contribution of slow recombination in localized subgap states to the excess quasiparticle population in ordered superconductors
Eva Gurra, Douglas A. Bennett, Shannon M. Duff, Michael R. Vissers, and Joel N. Ullom
Phys. Rev. Research **8**, L012053 (2026) - Published 5 March, 2026

A slowdown in the recombination of quasiparticles that are localized in subgap states caused by impurities and disorder in superconducting thin films is considered. The energy scales for quasiparticle localization in commonly used aluminum and niobium thin films are characterized from density-of-states measurements, and slow recombination is found to be insufficient for explaining the universally observed excess quasiparticle population.

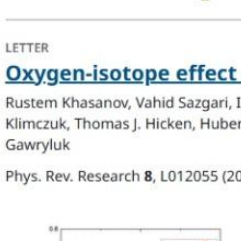
LETTER
Entropic size control of self-assembled filaments
Maximilian C. Hübl and Carl P. Goodrich
Phys. Rev. Research **8**, L012054 (2026) - Published 5 March, 2026

Size control of self-assembled filaments is achieved by introducing subunits with promiscuous binding interactions. Tuning these interactions controls the balance between the filaments' configurational entropy and binding free energy, thereby making it possible to program a preferred equilibrium size in a scalable way.

LETTER
Oxygen-isotope effect on the density-wave transitions in
Rustem Khasanov, Vahid Sazgari, Igor Plokhikh, Lifen Shi, Ketuan Ma, Marisa Medarde, Ekaterina Pomjakushina, Tomasz Klimczuk, Thomas J. Hicken, Hubertus Luetkens, Christof W. Schneider, Zurab Guguchia, Sergey Medvedev, and Dariusz J. Gawryluk
Phys. Rev. Research **8**, L012055 (2026) - Published 9 March, 2026

This work shows how replacing regular oxygen atoms with heavier ones affects electronic order in two Ruddlesden-Popper (RP) nickelate compounds related to high-temperature superconductors.

LETTER
Breaking global symmetries with locality-preserving operations
Michele Mazzoni, Luca Capizzi, and Lorenzo Piroli
Phys. Rev. Research **8**, L012056 (2026) - Published 6 March, 2026


This works proves that, in any spatial dimension, the U(1) and the SU(2) entanglement asymmetry that can be achieved by acting with locality-preserving operations on short-correlated quantum many-body states is half the maximum value. In contrast, symmetric states with long-range entanglement can attain maximal asymmetry when evolved via locality-preserving operations.

LETTER
Thresholded quantum sensing with a frustrated Kitaev trimer
C. Huerta Alderete, Anubhav Kumar Srivastava, Bharath Hebbe Madhusudhana, and Andrew T. Sornborger
Phys. Rev. Research **8**, L012057 (2026) - Published 6 March, 2026

A thresholded quantum sensor based on a frustrated three-spin Kitaev trimer, whose spectral structure suppresses response to zero-mean signals below a threshold, while enabling phase accumulation above it, is analyzed. Its nonlinear sensing behavior, robustness, scaling with entangled inputs, and experimental feasibility in a neutral-atom platform is characterized.

LETTER
Analytical phase boundary of a quantum driven-dissipative Kerr oscillator from classical stochastic instantons
Théo Sépulcre
Phys. Rev. Research **8**, L012058 (2026) - Published 9 March, 2026

The quantum model of a driven-dissipative Kerr oscillator is mapped onto the dynamics of a classical stochastic particle, allowing researchers to study the first-order transition appearing in the thermodynamic limit and to compute the phase boundary position using a minimal action path approach.

LETTER
Non-Gaussian statistics of concentration fluctuations in free liquid diffusion
Marco Bussoletti, Mirko Gallo, Amir Jafari, and Gregory L. Eyink
Phys. Rev. Research **8**, L012059 (2026) - Published 10 March, 2026

Fluctuations of solute concentration in a liquid solvent during free diffusion are studied by a high-Schmidt reduction of Landau-Lifshitz hydrodynamics, both analytically and by a massively parallel Lagrangian Monte Carlo simulation. Non-Gaussian statistics result from nonlinear coupling to thermal velocity fluctuations, persisting for vanishingly small mean concentration gradients and vitiating any central limit theorem in that limit.

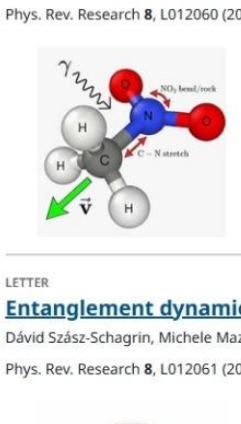
LETTER
Small molecule propulsion driven by solvent-mediated ultrafast energy transfer from vibrations to self-translation
Arnau Jurado Romero, Carles Calero, and Rossend Rey
Phys. Rev. Research **8**, L012060 (2026) - Published 10 March, 2026

All-atom molecular dynamics simulations demonstrate that the vibrational excitation of nitromethane in water can lead to transient directed propulsion. Under periodic excitation, this solvent-mediated mechanism results in a measurable enhancement of the molecule's translational diffusion coefficient.

LETTER
Entanglement dynamics and Page curves in random permutation circuits
Dávid Szász-Schagrin, Michele Mazzoni, Bruno Bertini, Katja Klobas, and Lorenzo Piroli
Phys. Rev. Research **8**, L012061 (2026) - Published 13 March, 2026

Permutation circuits are a special family of quantum circuits that, acting classically on a given basis of states, allow one to address the role played by "quantumness" in quantum dynamics. This work provides general bounds on the amount of quantum entanglement that permutation circuits can generate and presents exact results for the entanglement dynamics generated by permutation circuits when acting on product states.

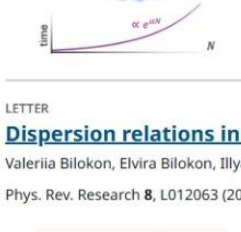
LETTER
Blueprint for experiments exploring the quantum recurrence theorem on a coupled multiqubit system
Bayan Karimi, Xuntao Wu, Andrew N. Cleland, and Jukka P. Pekola
Phys. Rev. Research **8**, L012062 (2026) - Published 13 March, 2026


Researchers present a rigorous analysis of quantum Poincaré revivals in a realistic, coupled multiqubit system and propose a feasible superconducting-circuit experiment on them. The work links the observed behavior to the question of how and whether isolated quantum systems thermalize, demonstrating that the revivals provide a probe of the persistence of nonthermal quantum dynamics.

LETTER
Dispersion relations in two- and three-dimensional quantum systems
Valeriia Bilokon, Elvira Bilokon, Illya Lukin, Andrii Sotnikov, and Denys I. Bondar
Phys. Rev. Research **8**, L012063 (2026) - Published 13 March, 2026

A tensor-network framework is presented for extracting momentum-resolved dispersion relations from imaginary-time evolution within the infinite projected entangled-pair states ansatz. Benchmarking on the transverse-field Ising model, the method captures excitation spectra in both two and three dimensions across different phases.

LETTER
Chiral exceptional bound states in the continuum: A higher-order singularity for on-chip control of quantum emission
Jin Li, Kexun Wu, Qi Hao, Yan Chen, and Jiawei Wang
Phys. Rev. Research **8**, L012064 (2026) - Published 17 March, 2026

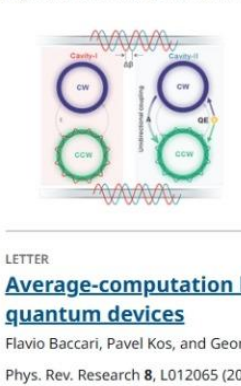


By controlling external coupling phases and unidirectional feedback in a waveguide-coupled dual-microring resonator system, this study demonstrates a non-Hermitian degeneracy termed exceptional quasibound states in the continuum. The approach enables tunable control over spontaneous emission dynamics, establishing a controllable platform for chiral light-matter interactions in integrated photonic circuits.

LETTER
Average-computation benchmarking for local expectation values in digital quantum devices
Flavio Baccari, Pavel Kos, and Georgios Styliaris
Phys. Rev. Research **8**, L012065 (2026) - Published 17 March, 2026

Schemes to benchmark quantum computations by averaging a target circuit with variants that preserve the original architecture and depth while yielding classically solvable correlation functions are presented. A few explicit constructions applicable to arbitrary brickwork circuits and a general recipe to find new ones through semidefinite programming are provided.

LETTER
Observing octupolar charge orders and their transition dynamics in Coulomb clusters
Akhil Ayyadevara, Anand Prakash, Shovan Dutta, Arun Paramekanti, and S. A. Rangwala
Phys. Rev. Research **8**, L012066 (2026) - Published 18 March, 2026



Laser-cooled ions self-organize into diverse crystalline orders with rich symmetries to balance harmonic confinement and mutual Coulomb repulsion. This study realizes three distinct symmetry-breaking mechanisms near structural transitions with these Coulomb clusters and experimentally captures their dynamical signatures, demonstrating the interplay between symmetry, collective dynamics, and transition pathways in few-body systems.

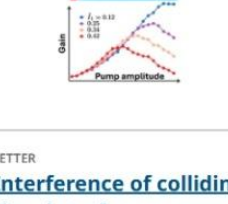
LETTER
Atomic Josephson parametric amplifier
Vijay Pal Singh, Luigi Amico, and Ludwig Mathey
Phys. Rev. Research **8**, L012067 (2026) - Published 20 March, 2026

Parametric amplification is a cornerstone of nonlinear physics and quantum sensing, typically described with effective circuit models. A proposed implementation based on a driven atomic Josephson junction enables direct microscopic observation of the dynamics behind the amplification process. The system uncovers dephasing-limited gain and intrinsic saturation, paving the way toward atomtronic quantum-limited amplifiers and engineered nonlinear quantum devices.

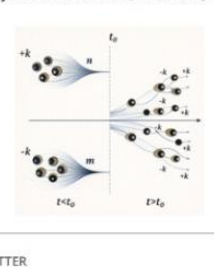
LETTER
Interference of colliding Fock states and vacuum-generated photon pairs at time interfaces
Nikita Nefedkin, Emanuele Galiffi, and Andrea Alù
Phys. Rev. Research **8**, L012068 (2026) - Published 23 March, 2026

This work analyzes the quantum interference of counterpropagating photonic Fock states at a time interface, produced by an abrupt change of the material parameters, and describes how vacuum-generated photon pairs contribute to the output correlations. An analytical model provides postinterface photon number distributions and intensity correlations, highlighting opportunities for the observation of exotic coincidence statistics in this setting.

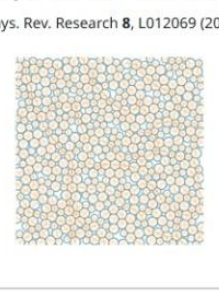
LETTER
Relaxation dynamics and long-time tails explain shear-induced diffusion of soft athermal particles near jamming
Kuniyasu Saitoh and Takeshi Kawasaki
Phys. Rev. Research **8**, L012069 (2026) - Published 24 March, 2026


The shear-induced diffusion coefficient of soft athermal particles, such as foams, emulsions, and granular materials, exhibits critical scaling near the jamming transition and diverges in the thermodynamic limit when the system is above the jamming point. This work demonstrates that the shear-induced diffusion coefficient is governed by both the relaxation time and transverse velocity fluctuations, and that its divergence can be attributed to a long-time tail in the transverse velocity autocorrelation function.

LETTER
Optimal superconductivity in twisted bilayer where the Van Hove singularity crosses half-filling
Michał Zegrodnik, Waseem Akbar, Andrzej Biborski, and Louk Rademaker
Phys. Rev. Research **8**, L012070 (2026) - Published 25 March, 2026

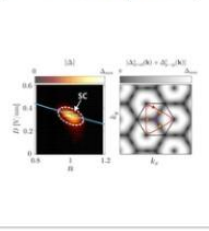

This study shows that the fundamental feature of unconventional superconductivity in twisted bilayer WSe can be explained as a subtle interplay between the large density of states of the Van Hove singularity, in combination with the renormalization effects that appear in the weak-to-moderate correlations regime. The two factors create favorable conditions for the superconducting pairing only in a small area of the phase diagram.

LETTER
Simulating correlated electrons with symmetry-enforced normalizing flows
Dominic Schuh, Janik Kreit, Evan Berkowitz, Lena Funcke, Thomas Luu, Kim A. Nicoli, and Marcel Rodekamp
Phys. Rev. Research **8**, L012071 (2026) - Published 25 March, 2026



A generative machine learning approach using symmetry-enforced normalizing flows is used to sample from the Boltzmann distribution of the fermionic Hubbard model. By incorporating physical symmetries into the neural network architecture, the method produces unbiased samples and resolves ergodicity issues typically associated with traditional Markov chain Monte Carlo techniques.

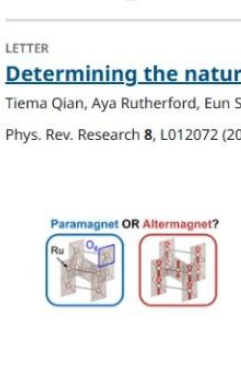
LETTER
Determining the nature of magnetism in altermagnetic candidate
Tiema Qian, Aya Rutherford, Eun Sang Choi, Haidong Zhou, Boris Maiorov, Minseong Lee, and Christopher A. Mizzi
Phys. Rev. Research **8**, L012072 (2026) - Published 26 March, 2026



The authors use a combination of symmetry-sensitive, thermodynamic measurements with Fermi surface mapping via high-field quantum oscillations to explore RuO as a potential altermagnetic candidate.

ARTICLES

Quantifying the irregularity of a time series
Max Potratzki, Manuel Adams, Timo Bröhl, and Klaus Lehnertz
Phys. Rev. Research **8**, 013001 (2026) - Published 2 January, 2026



Circulance is introduced as a scalar measure that quantifies the irregularity of a time series based on the topology of ordinal pattern transition networks. It enables the positioning of a time series along a continuous spectrum from regular toward randomness.

Hidden multiphoton dynamics in the Heitler regime of resonance fluorescence
Yanfeng Li, Manman Wang, Chuanyu Zeng, Hanqing Liu, Haiqiao Ni, Zhichuan Niu, and Chengyong Hu
Phys. Rev. Research **8**, 013002 (2026) - Published 2 January, 2026

Emergent bifurcation and robust decision-making in neurodynamic swarms
Peng Ren, Jiang Zhao, Pei Chi, and Yingxun Wang
Phys. Rev. Research **8**, 013003 (2026) - Published 5 January, 2026

Global thermodynamic manifold for conservative control of stochastic systems