Volume 7, Issue 2

April - June 2025

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HIGHLIGHTED ARTICLES

FEATURED IN PHYSICS

Excitable dynamics and coral reef formation: A simple model of macro-scale structure development

Miguel Álvarez-Alegría, Pablo Moreno-Spiegelberg, Manuel A. Matías, and Damià Gomila

Phys. Rev. Research **7**, 023196 (2025) - Published 28 May, 2025

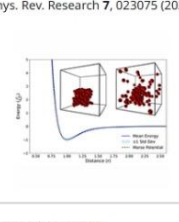
A 1D model based on mineral accumulation and polyp mortality shows traveling pulses that drive atoll-like patterns.

EDITORS' SUGGESTION

Inferring interaction potentials from stochastic particle trajectories

Ella M. King, Megan C. Engel, Caroline Martin, Alp M. Sunol, Qian-Ze Zhu, Sam S. Schoenholz, Vinothan N. Manoharan, and Michael P. Brenner

Phys. Rev. Research **7**, 023075 (2025) - Published 22 April, 2025



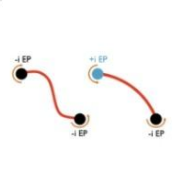
A novel technique is introduced that extracts interparticle forces directly from trajectories of microscopic particles undergoing stochastic motion. The method is validated on both simulated and experimental data, and it is explicitly demonstrated that the method works on systems far from equilibrium.

EDITORS' SUGGESTION

Topology and manipulation of scattering singularities in complex non-Hermitian systems: Two-channel case

Jared Erb, Nadav Shaibe, Robert Calvo, Daniel P. Lathrop, Thomas M. Antonsen, Jr., Tsampikos Kottos, and Steven M. Anlage

Phys. Rev. Research **7**, 023090 (2025) - Published 25 April, 2025



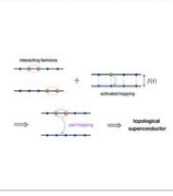
By harnessing tunable parameters, singularities of the scattering matrix can be actively manipulated, resulting in a deeper understanding of their topology, dynamics, and interactions in generic complex resonant systems. Through their deliberate manipulation, independent singularities can be brought into coincidence in parameter space, enabling unique applications in these systems, despite having no predesigned structure for such applications.

EDITORS' SUGGESTION

Dynamic realization of Majorana zero modes in a particle-conserving ladder

Anaïs Defossez, Laurens Vanderstraeten, Lucila Peralta Gavensky, and Nathan Goldman

Phys. Rev. Research **7**, 023183 (2025) - Published 27 May, 2025



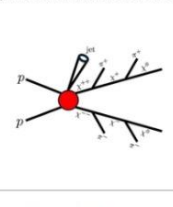
A proposed scheme aims to realize pair-hopping processes on a ladder geometry by activating single-particle hopping processes between two decoupled fermionic chains. This method allows for a dynamic realization of Majorana zero modes within a particle-conserving framework.

EDITORS' SUGGESTION

How to falsify string theory at a collider

Matthew Baumgart, Panagiotis Christeas, Jonathan J. Heckman, and Rebecca J. Hicks

Phys. Rev. Research **7**, 023184 (2025) - Published 27 May, 2025



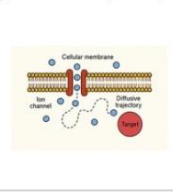
This article study phenomenologically well-motivated scenarios which would rule out string theory landscape. The main class of "string-killer" models explored are those in which the Standard Model is supplemented by a single new field in a high-dimensional representation of weak isospin.

EDITORS' SUGGESTION

Fastest first-passage time statistics for time-dependent particle injection

Denis S. Grebenkov, Ralf Metzler, and Gleb Oshanin

Phys. Rev. Research **7**, 023239 (2025) - Published 9 June, 2025



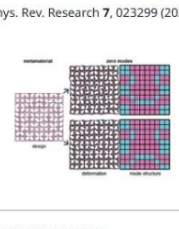
The competitive search for a target by diffusive searchers (for example, biomolecular messengers) in a finite domain (for example, a biological cell) is considered when these searchers are released according to a prescribed distribution over a window of time. For this scenario the full statistic of the fastest searcher is determined, finding a slow convergence to the limit of large numbers of searchers.

EDITORS' SUGGESTION

Prospecting for pluripotency in metamaterial design

Ryan van Mastrigt, Marjolein Dijkstra, Martin van Hecke, and Corentin Coulais

Phys. Rev. Research **7**, 023299 (2025) - Published 24 June, 2025



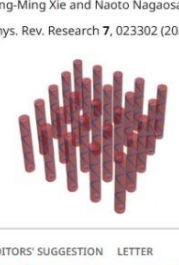
A two-step design protocol for combinatorial mechanical metamaterials is proposed and applied to a metamaterial capable of multiple spatially extended zero-energy deformation modes. This protocol allows for the design of targeted modes with complex spatial structures.

EDITORS' SUGGESTION

Quasi-one-dimensional supersolids in Luther-Emery liquids

Ying-Ming Xie and Naoto Nagaosa

Phys. Rev. Research **7**, 023302 (2025) - Published 24 June, 2025



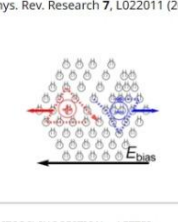
A variational approach is used to show that supersolid phases with coexisting charge-density wave and superconducting order are favored in finite Luttinger-Emery chains, and their collective dynamics are analyzed.

EDITORS' SUGGESTION LETTER

Nonlinear transport of Wigner solid phase surrounding the two-flux composite fermion liquid

Yu-jiang Dong, Xinghao Wang, Jianmin Zheng, Weiliang Qiao, Rui-Rui Du, Loren N. Pfeiffer, Kenneth W. West, and Kirk W. Baldwin

Phys. Rev. Research **7**, L022011 (2025) - Published 9 April, 2025



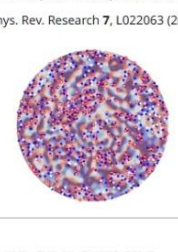
Nonlinear transport studies are performed to investigate the low-temperature behavior of a CF-2 Wigner solid surrounded by fractional quantum Hall liquid. The electric-field-temperature duality phenomenon of a Wigner solid was observed, which is interpreted within the Berezinskii-Kosterlitz-Thouless phase transition model.

EDITORS' SUGGESTION LETTER

Topological pathways to two-dimensional quantum turbulence

R. Panico, G. Ciliberto, G. I. Martone, T. Congy, D. Ballarini, A. S. Lanotte, and N. Pavloff

Phys. Rev. Research **7**, L022063 (2025) - Published 11 June, 2025



A joint theoretical and experimental investigation of a two-dimensional quantum fluid of exciton polaritons highlights the crucial role of topological conservation laws in both the growth and decay of turbulence.

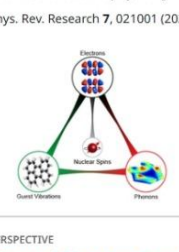
PERSPECTIVES

PERSPECTIVE

Small but large: Single organic molecules as hybrid platforms for quantum technologies

Burak Gurlek and Daqing Wang

Phys. Rev. Research **7**, 021001 (2025) - Published 22 May, 2025



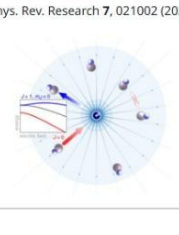
Scientists have found that individual organic molecules placed in solid materials can offer far more than just single-photon emission. This Perspective revisits single-molecule solid-state systems, uncovering their rich internal structure and outlining how these molecular platforms could be harnessed to store quantum information, link light with spin states, function as miniature qubit registers, or serve as efficient optomechanical elements.

PERSPECTIVE

Ultracold interactions between ions and polar molecules

Leon Karpa and Olivier Dulieu

Phys. Rev. Research **7**, 021002 (2025) - Published 25 June, 2025



A platform for combining ultracold ions and molecular quantum gases is proposed. In this system, the rotational degrees of freedom of polar molecules can be used to control the strength and character of several simultaneously active interactions as well as related properties such as chemical reactivity or the thresholds for quantum-dominated behavior.

LETTERS

LETTER

Helicity is a topological invariant of massless particles: $C=-2h$

Eric Palmerduca and Hong Qin

Phys. Rev. Research **7**, L022001 (2025) - Published 2 April, 2025

$$\gamma_h = \bigotimes_{i=1}^{h} \gamma_1^{\mathrm{sgn}(h)}$$

$$C(\gamma_h) = -2h$$

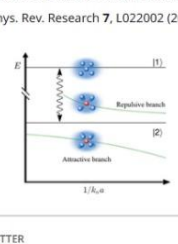
Representations of massless particles can be constructed through repeated tensor products of the photon bundles. This shows that the nontrivial topology of massless particles, characterized by the Chern number C, is related to their geometric helicity h via $C = -2h$.

LETTER

Quantum beat spectroscopy of repulsive Bose polarons

A. M. Morgen, S. S. Balling, K. Knakkergaard Nielsen, T. Pohl, G. M. Bruun, and J. J. Arlt

Phys. Rev. Research **7**, L022002 (2025) - Published 2 April, 2025



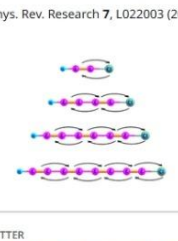
The interferometric observation of strongly repulsive impurities in a quantum degenerate gas of ^{39}K atoms is reported on. An observed revival in the interferometric signal corresponds to a quantum beat between two quasiparticle branches, from which key properties of the impurity are extracted.

LETTER

Coherences of charge migration increasing with molecular size: A case study for chloro-alkyne ions $\mathrm{H(CC)}_n\mathrm{Cl}^+$

Huihui Wang, Xue Ren, Xinran Ren, Liantuan Xiao, Suotang Jia, and Yonggang Yang

Phys. Rev. Research **7**, L022003 (2025) - Published 3 April, 2025



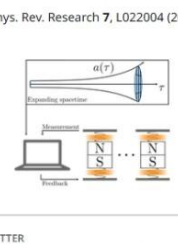
Systematic investigations of the charge migration in a series of chloro-alkyne ions H(CC)$_n$Cl$^+$ reveals a counterintuitive phenomenon: the overall extent of electronic coherence increases with molecular size. Long-lived charge migration is found in H(CC)$_3$Cl$^+$ and H(CC)$_4$Cl$^+$, with a lifetime about 1 order of magnitude longer than most previously reported cases.

LETTER

Mechanical cosmology: Simulating scalar fluctuations in expanding universes using synthetic mechanical lattices

Brendan Rhyno, Ivan Velkovsky, Peter Adshead, Bryce Gadway, and Smitha Vishveshwara

Phys. Rev. Research **7**, L022004 (2025) - Published 3 April, 2025



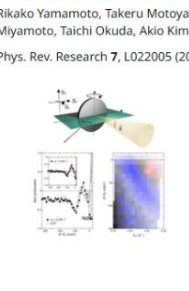
Analog simulations of a quantum scalar field in an expanding background spacetime are performed using a network of mechanical oscillators coupled through measurement-based synthetic interactions. Expanding Universe scenarios described by the Friedmann–Lemaître-Robertson-Walker metric, relevant to inflationary cosmology, are explored.

LETTER

Spin splitting in the surface electronic structure of antiferromagnet NdBi

Rikako Yamamoto, Takeru Motoyama, Takuma Iwata, Towa Kosa, Yukimi Nishioka, Kazumasa Ideura, Masashi Arita, Koji Miyamoto, Taichi Okuda, Akio Kimura, Takemi Yamada, Yuki Yanagi, Takahiro Onimaru, and Kenta Kuroda

Phys. Rev. Research **7**, L022005 (2025) - Published 3 April, 2025



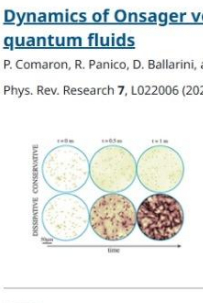
Laser-based spin- and angle-resolved photoemission spectroscopy is used to investigate the spin and electronic structure of NdBi in its antiferromagnetic state. The study provides direct evidence of spin splitting in the surface states and identifies inversion symmetry breaking as its origin, supported by momentum-dependent spin-polarization measurements. Furthermore, density functional theory calculations indicate that these surface states exist within the band gap determined by exchange splitting and are sensitive to the magnetic order of the $4f$ orbitals.

LETTER

Dynamics of Onsager vortex clustering in decaying turbulent polariton quantum fluids

P. Comaron, R. Panico, D. Ballarini, and M. Matuszewski

Phys. Rev. Research **7**, L022006 (2025) - Published 4 April, 2025



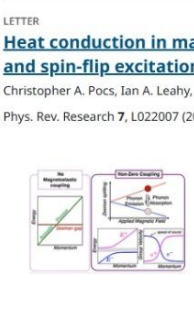
Numerical simulations uncover the conditions for Onsager vortex clustering in decaying turbulent polariton quantum fluids. By examining dissipation, vortex interactions, and system scales, the study identifies the key physical processes and optimal parameters for vortex clustering, enabling experimental exploration of decaying turbulent quantum fluids.

LETTER

Heat conduction in magnetic insulators via hybridization of acoustic phonons and spin-flip excitations

Christopher A. Pocs, Ian A. Leahy, Jie Xing, Eun Sang Choi, Athena S. Sefat, Michael Hermele, and Minhyea Lee

Phys. Rev. Research **7**, L022007 (2025) - Published 7 April, 2025



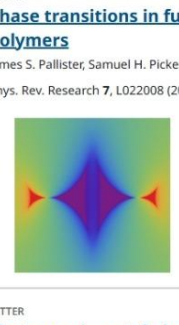
Lattice vibrations and spin excitations are shown to quantum mechanically hybridize to give rise to a surprising behavior of thermal conductivity upon an applied magnetic field, which is observed in the well-characterized magnetic insulator CsYbSe$_2$. This behavior is captured in a simple model based on two common ingredients—magnetoelastic coupling and the Zeeman gap—raising the prospect of universal heat conduction under a magnetic field across a range of magnetic insulators.

LETTER

Phase transitions in full counting statistics of free fermions and directed polymers

James S. Pallister, Samuel H. Pickering, Dimitri M. Gangardt, and Alexander G. Abanov

Phys. Rev. Research **7**, L022008 (2025) - Published 8 April, 2025



The behavior of directed polymers in 1+1 dimensions under the influence of an external repulsive potential is explored. By mapping the system onto the evolution of free fermions in imaginary time, it is demonstrated that a continuous phase transition occurs when the potential becomes sufficiently strong, leading to the merging of empty regions in the dominant limit shape.

LETTER

First experimental observation of zonal flows in the optimized stellarator Wendelstein 7-X

D. Carralero, T. Estrada, J. M. García-Regaña, E. Sánchez, T. Windisch, A. Alonso, E. Maragkoudakis, C. Brandt, K. J. Brunner, C. Gallego-Castillo, P. Kornejew, K. Parks, K. Rahbarnia, H. Thienpondt, and The Wendelstein 7-X Team

Phys. Rev. Research **7**, L022009 (2025) - Published 8 April, 2025

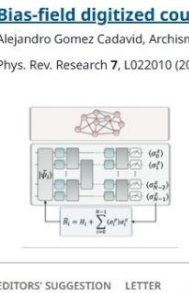
This work uses the Wendelstein 7-X device to show empirical confirmation of the presence of zonal flows in a large, optimized stellarator. The experimental characterization of the zonal flow is in agreement with the predictions from two independent gyrokinetic codes.

LETTER

Bias-field digitized counterdiabatic quantum optimization

Alejandro Gomez Cadavid, Archismita Dalal, Anton Simen, Enrique Solano, and Narendra N. Hegade

Phys. Rev. Research **7**, L022010 (2025) - Published 9 April, 2025



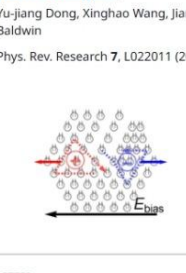
Bias-field DCQO is a nonvariational algorithm that targets combinatorial optimization problems experimentally on current noisy quantum digital hardware. It shows empirical polynomial enhancement with respect to other standard quantum algorithms, such as finite-time digitized quantum annealing.

EDITORS' SUGGESTION LETTER

Nonlinear transport of Wigner solid phase surrounding the two-flux composite fermion liquid

Yu-jiang Dong, Xinghao Wang, Jianmin Zheng, Weiliang Qiao, Rui-Rui Du, Loren N. Pfeiffer, Kenneth W. West, and Kirk W. Baldwin

Phys. Rev. Research **7**, L022011 (2025) - Published 9 April, 2025



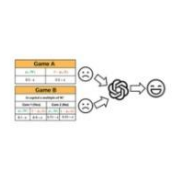
Nonlinear transport studies are performed to investigate the low-temperature behavior of a CF-2 Wigner solid surrounded by fractional quantum Hall liquid. The electric-field-temperature duality phenomenon of a Wigner solid was observed, which is interpreted within the Berezinskii-Kosterlitz-Thouless phase transition model.

LETTER

Adaptive strategy automation with large language models in paradoxical games

Kang Hao Cheong, Jie Zhao, and Tao Wen

Phys. Rev. Research **7**, L022012 (2025) - Published 10 April, 2025



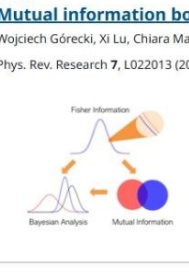
Through comprehensive simulations, this work demonstrates that large language models can autonomously generate adaptive switching strategies that outperform fixed sequences in profitability across certain paradoxical coin-tossing games. The findings show that the method effectively reduces human effort while adapting to different game variants.

LETTER

Mutual information bounded by Fisher information

Wojciech Górecki, Xi Lu, Chiara Macchiavello, and Lorenzo Maccone

Phys. Rev. Research **7**, L022013 (2025) - Published 11 April, 2025



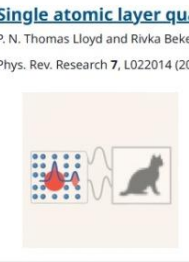
A general upper bound on mutual information in terms of the Fisher information is derived, which further leads to a lower bound on the Bayesian quadratic cost. Both classical and quantum versions of the bound are presented, along with applications to quantum metrology and quantum communication.

LETTER

Single atomic layer quantum holography

P. N. Thomas Lloyd and Rivka Bekenstein

Phys. Rev. Research **7**, L022014 (2025) - Published 11 April, 2025



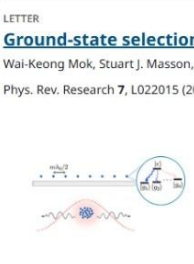
Researchers demonstrate a novel quantum holography technique using two-dimensional atomic arrays to precisely control the phase distribution of quantum photonic states and encode arbitrary recoverable images, thereby establishing a quantitative mapping between atomic and photonic states for many-body atom-photon entangled systems.

LETTER

Ground-state selection via many-body superradiant decay

Wai-Keong Mok, Stuart J. Masson, Dan M. Stamper-Kurn, Tanya Zelevinsky, and Ana Asenjo-Garcia

Phys. Rev. Research **7**, L022015 (2025) - Published 14 April, 2025



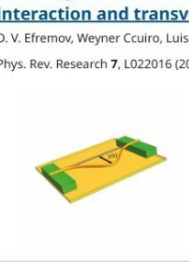
An analytical framework for the collective decay of many-body quantum systems with competing decay channels is presented. The study proves the emergence of a "winner takes all" dynamic, where interactions suppress all but the dominant decay transition, drastically amplifying the occupation of the dominant ground state beyond the constraints imposed by the system's natural branching ratios.

LETTER

Breaking of Lorentz invariance caused by the interplay between spin-orbit interaction and transverse phonon modes in quantum wires

D. V. Efremov, Weyner Ccuiro, Luis E. F. Foa Torres, and M. N. Kiselev

Phys. Rev. Research **7**, L022016 (2025) - Published 14 April, 2025



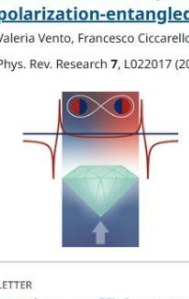
A nanomechanical device using a suspended quantum wire with strong spin-orbit interaction is proposed for detecting quantum phase transitions. The work explores the interplay between electron orbital degrees of freedom and bending elastic modes, providing a framework for detecting quantum critical points.

LETTER

How to use the dispersion in the $\chi^{(3)}$ tensor for broadband generation of polarization-entangled photons

Valeria Vento, Francesco Ciccarello, Sakthi Priya Amirtharaj, and Christophe Galland

Phys. Rev. Research **7**, L022017 (2025) - Published 16 April, 2025



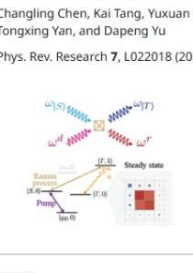
Motivated by measurements in diamond, this work presents general principles for using phonon resonances to tailor the polarization quantum states produced via spontaneous four-wave mixing. The approach exploits the interplay of electronic and vibrational contributions to the nonlinear response to generate broadband polarization-entangled photon pairs.

LETTER

Hardware-efficient stabilization of entanglement via engineered dissipation in superconducting circuits

Changling Chen, Kai Tang, Yuxuan Zhou, KangYuan Yi, Xuan Zhang, Xu Zhang, Haosheng Guo, Song Liu, Yuanzhen Chen, Tongxing Yan, and Dapeng Yu

Phys. Rev. Research **7**, L022018 (2025) - Published 16 April, 2025



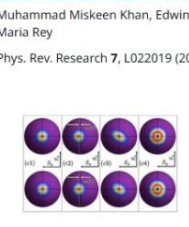
A hardware-efficient protocol is demonstrated for stabilizing entangled quantum states in cQED using a four-wave mixing process, where "hardware efficient" refers to the absence of any need for specialized quantum hardware. Steady entangled states with the highest reported fidelity for both two-qubit and three-qubit systems are experimentally achieved in cQED through an autonomous process.

LETTER

Generating Einstein-Podolsky-Rosen correlations for teleporting collective spin states in a two-dimensional trapped ion crystal

Muhammad Miskeen Khan, Edwin Chaparro, Bhuvanesh Sundar, Allison Carter, John Bollinger, Klaus Mølmer, and Ana Maria Rey

Phys. Rev. Research **7**, L022019 (2025) - Published 17 April, 2025



A proposed protocol allows for the teleportation of collective spin-coherent states, as well as entangled spin-squeezed and Dicke states, between nuclear spin degrees of freedom in a two-dimensional trapped-ion crystal. Beyond teleportation, generalizations of the protocol could be used for retroactive squeezing generation and enhanced displacement sensing in a Penning trap, as well as in other systems featuring collective spin-spin interactions within synthetic dimensions or spatially separated arrays.

LETTER

Toward resolving the discrepancy in helium-3 and helium-4 nuclear charge radii

Xiao-Qiu Qi, Pei-Pei Zhang, Zong-Chao Yan, Li-Yan Tang, Ai-Xi Chen, Ting-Yun Shi, and Zhen-Xiang Zhong

Phys. Rev. Research **7**, L022020 (2025) - Published 21 April, 2025

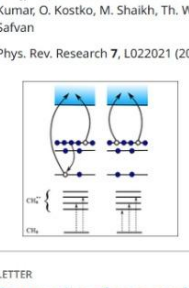
A recent puzzle regarding the nuclear size discrepancy, extracted from electronic helium atoms and muonic helium ions and once suspected to signal new physics, has now been resolved.

LETTER

State selectivity in core ionization of methane

J. Rajput, J. Stindl, A. Cassimi, B. Gervais, M. Kircher, G. Kastirke, O. D. McGinnis, R. Enoki, J. B. Williams, V. Davis, R. Saha, S. Kumar, O. Kostko, M. Shaikh, Th. Weber, D. S. Slaughter, N. Iwamoto, C. Bagdia, I. Ben-Itzhak, M. S. Schöffler, and C. P. Safvan

Phys. Rev. Research **7**, L022021 (2025) - Published 22 April, 2025



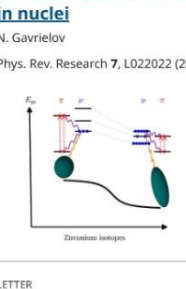
A comparative analysis is presented of the electronic states of methane dication [CH$_4$]$^{++}$ populated via Auger-Meitner decay following core ionization and by valence double ionization. The measurement shows that Auger-Meitner decay does not populate the triplet ground state of [CH$_4$]$^{++}$. Further, the dissociative channel [CH$_4$]$^{++}$ → CH$_3^+$ + H$^+$ results in the formation of hot methyl cation.

LETTER

Competing shape evolution, crossing configurations, and single particle levels in nuclei

N. Gavrielov

Phys. Rev. Research **7**, L022022 (2025) - Published 23 April, 2025



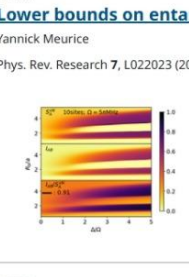
The interplay of shape-phase transitions, configuration crossings, and the evolution of single-quasiparticle energies in odd-mass zirconium isotopes is uncovered.

LETTER

Lower bounds on entanglement entropy without twin copy

Yannick Meurice

Phys. Rev. Research **7**, L022023 (2025) - Published 24 April, 2025



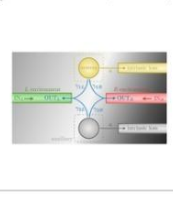
This work shows that the classical mutual information for the easily available bitstrings from a single copy of a quantum system allows identification of the regions of large quantum entanglement without interfering twin copies. The method is illustrated using cloud-based rubidium atom facilities.

LETTER

Accessing strongly coupled systems without compromising them

Xiangjin Kong, Carlos Navarrete-Benlloch, and Yue Chang

Phys. Rev. Research **7**, L022024 (2025) - Published 24 April, 2025



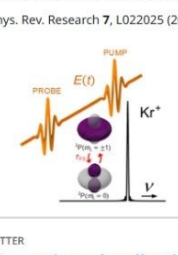
For certain quantum systems, the mitigation of decoherence requires large isolation, which has the unwanted side effect of making them difficult to access for control and monitoring purposes. In this theoretical proposal, an engineered environment is put forward that gives access to such highly isolated systems without compromising their quantum coherence.

LETTER

Isotope shift of fine structure of Kr^+ and hyperfine structure of $^{83}\mathrm{Kr}^+$ by strong-field ultrahigh-resolution Fourier-transform spectroscopy

Toshiaki Ando, Kana Yamada, Atsushi Iwasaki, and Kaoru Yamanouchi

Phys. Rev. Research **7**, L022025 (2025) - Published 25 April, 2025



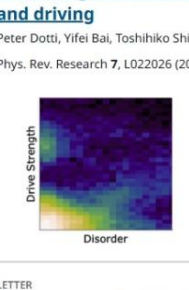
Researchers have achieved ultrahigh-resolution spectroscopy using ultrabroadband femtosecond laser pulses. A long-arm interferometer was developed to reach a sub-MHz precision, and evidence was discovered of the deformation of electron density distribution in Kr$^+$ by the relativistic effect.

LETTER

Measuring a localization phase diagram controlled by the interplay of disorder and driving

Peter Dotti, Yifei Bai, Toshihiko Shimasaki, Anna R. Dardia, and David M. Weld

Phys. Rev. Research **7**, L022026 (2025) - Published 28 April, 2025



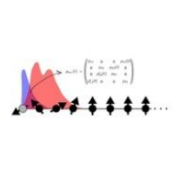
This work experimentally explores the interplay between quasiperiodic disorder and periodic driving, each of which in isolation can strongly modify transport in quantum matter. The full measured phase diagram features quantum phase boundaries that depend on both parameters and reveals effects beyond typically used theoretical approximations.

LETTER

Emergence of X states in a quantum impurity model

Moallison F. Cavalcante, Marcus V. S. Bonança, Eduardo Miranda, and Sebastian Deffner

Phys. Rev. Research **7**, L022027 (2025) - Published 2 May, 2025



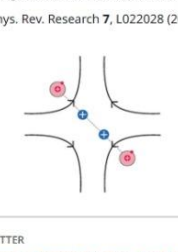
Through a local (and simple) manipulation of a many-body system, this work shows that it is possible to store and trap genuine quantum information and energy in its collective localized edge modes. The characterization of the information stored shows that quantum correlations are enhanced in the nonequilibrium regime of manipulation. Hence, the work presents the minimal elements one must search for to produce the same effects in different setups.

LETTER

Vibrationally coupled Rydberg atom-ion molecules

Ilango Maran, Liam J. Bond, Jeremy T. Young, Arghavan Safavi-Naini, and Rene Gerritsma

Phys. Rev. Research **7**, L022028 (2025) - Published 2 May, 2025



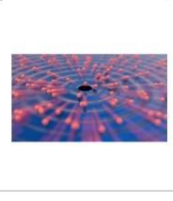
A scheme is proposed to mediate Rydberg-Rydberg interactions over a range larger than the typical blockade radius using a molecular state formed by a Rydberg atom and an ion (RAIM) by coupling the motional modes of the trapped ion crystal to the vibrational mode of the RAIM. The effects of the Paul trap's rf potential on the RAIM is studied using a detailed Floquet analysis along with scaling laws informed by Landau-Zener-Stuckleberg interferometry.

LETTER

Two-dimensional hydrodynamic viscous electron flow in annular Corbino rings

Sujatha Vijayakrishnan, Z. Berkson-Korenberg, J. Mainville, L. W. Engel, M. P. Lilly, K. W. West, L. N. Pfeiffer, and G. Gervais

Phys. Rev. Research **7**, L022029 (2025) - Published 2 May, 2025



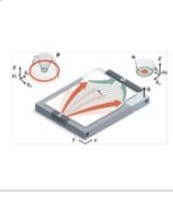
Measurements are presented that show signatures of viscous electron flow in purely bulk concentric geometries, with nonlocal electronic transport effects observed far from the current path.

LETTER

Aharonov-Bohm interferometer in inverted-band pn junctions

Yuhao Zhao, Oded Zilberberg, and Antonio Štrkalj

Phys. Rev. Research **7**, L022030 (2025) - Published 7 May, 2025



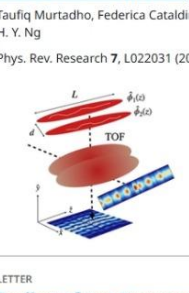
A novel Aharonov-Bohm interferometer based on negative refraction in a 2D inverted-band pn junction is presented. The electron trajectories are confined not by external structures but by the intrinsic sombrero-shaped band structure, enabling robust quantum interference observable under realistic experimental conditions.

LETTER

Measurement of total phase fluctuation in cold-atomic quantum simulators

Taufiq Murtadho, Federica Cataldini, Sebastian Erne, Marek Gluza, Mohammadamin Tajik, Jörg Schmiedmayer, and Nelly H. Y. Ng

Phys. Rev. Research **7**, L022031 (2025) - Published 7 May, 2025



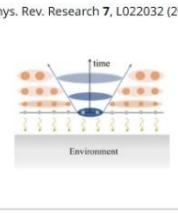
A method is introduced to measure the total phase fluctuations and their correlations in low-dimensional quantum Bose gases by inverting a continuity equation. The scheme is validated through theoretical analysis, numerical simulations, and experimental demonstrations using a 1D quantum field simulator.

LETTER

Scaling of von Neumann entropy in dissipative Liouvillian dynamics

Wei-Zhu Yi, Hao-Jie Lin, Ze-Xun Lin, Rui Wang, and Wei-Qiang Chen

Phys. Rev. Research **7**, L022032 (2025) - Published 7 May, 2025



A universal short-time rapid growth of von Neumann entropy is found in systems with quasiparticles under a Markovian dissipative environment. This behavior is verified in noninteracting fermionic open systems and dissipative Luttinger liquid.

LETTER

Two-dimensional topological Anderson insulator in a HgTe-based semimetal

D. A. Khudaiberdiev, Z. D. Kvon, M. S. Ryzhkov, D. A. Kozlov, N. N. Mikhailov, and A. Pimenov

Phys. Rev. Research **7**, L022033 (2025) - Published 9 May, 2025

A semimetallic 2D electron system is shown to be able to transform into an Anderson topological insulator under strong disorder. The disorder induces a mobility gap in the bulk, while leaving the 1D edge states topologically protected.

LETTER

Quantum metrology with higher-order exceptional points in atom-cavity magnonics

Minwei Shi, Guzhi Bao, Jinxian Guo, and Weiping Zhang

Phys. Rev. Research **7**, L022034 (2025) - Published 9 May, 2025

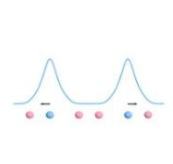
A protocol for quantum metrology with the construction of higher-order exceptional points (HOEPs) is proposed and analyzed in the atom-cavity system through Hermitian magnon-photon interactions. The study unveils the mechanism and the physical origin behind the quantum enhancement from this type of HOEPs.

LETTER

Directional transport in Rydberg atom arrays via kinetic constraints and temporal modulation

Yupeng Wang, Junjie Wang, Aishik Panja, Xinghan Wang, and Qi-Yu Liang

Phys. Rev. Research **7**, L022035 (2025) - Published 15 May, 2025



A method to transport Rydberg excitations and entangled states in atomic arrays in arbitrary paths is proposed. By combining nonuniform interatomic spacings and temporal frequency modulation, simulations demonstrate fast yet high-fidelity transport under experimentally achievable conditions.

LETTER

Laser-induced quenching of the Th-229 nuclear clock isomer in calcium fluoride

F. Schaden, T. Riebner, I. Morawetz, L. Toscani De Col, G. A. Kazakov, K. Beeks, T. Sikorsky, T. Schumm, K. Zhang, V. Lal, G. Zitzer, J. Tiedau, M. V. Okhapkin, and E. Peik

Phys. Rev. Research **7**, L022036 (2025) - Published 16 May, 2025

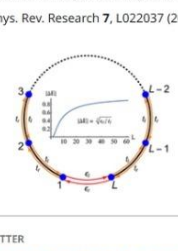
A study shows that the lifetime of the first nuclear excited state of thorium-229 in a calcium fluoride crystal environment can be reduced by exposure to off-resonant laser light. The effect of "light induced nuclear quenching" shows a strong dependence on the crystal temperature, laser wavelength, and laser power, indicating a controllable coupling between electronic and nuclear degrees of freedom.

LETTER

Enhanced sensitivity in non-Hermitian systems at infernal points

Shu-Xuan Wang and Zhongbo Yan

Phys. Rev. Research **7**, L022037 (2025) - Published 19 May, 2025



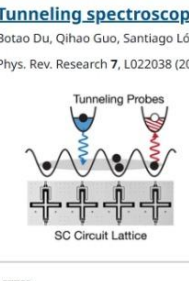
Using perturbation theory for Jordan matrices, this work derives the condition under which non-Hermitian systems near infernal points exhibit the maximal-order spectral-splitting scaling under perturbations. The theory's universality is demonstrated through paradigmatic models.

LETTER

Tunneling spectroscopy in superconducting circuit lattices

Botao Du, Qihao Guo, Santiago López, and Ruichao Ma

Phys. Rev. Research **7**, L022038 (2025) - Published 19 May, 2025



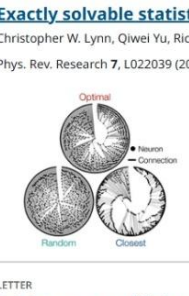
Engineered driven-dissipative particle source and drain act as local tunneling probes for site-resolved spectroscopy in superconducting circuit Bose-Hubbard lattices, enabling independent measurement of quasiparticle and quasihole excitation spectra across the superfluid-Mott transition and revealing signatures of three-body interactions

LETTER

Exactly solvable statistical physics models for large neuronal populations

Christopher W. Lynn, Qiwei Yu, Rich Pang, William Bialek, and Stephanie E. Palmer

Phys. Rev. Research **7**, L022039 (2025) - Published 19 May, 2025



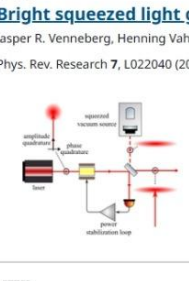
Statistical mechanics provides a framework for understanding how large-scale neural activity emerges from the fine-scale correlations between neurons. Using the "minimax entropy" principle, this work presents an exact method for constructing statistical physics models of very large populations of neurons.

LETTER

Bright squeezed light generation via nonclassical power stabilization

Jasper R. Venneberg, Henning Vahlbruch, Marina Trad Nery, and Benno Willke

Phys. Rev. Research **7**, L022040 (2025) - Published 20 May, 2025



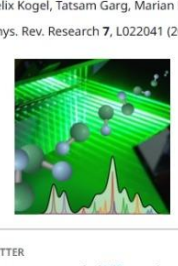
Light sources with low power fluctuations are an essential tool for high-precision laser metrology. Because of the quantum nature of light, shot noise imposes a fundamental limit on the power stability achievable with classical light sources. This work demonstrates the generation of a bright state of light with sub-shot-noise power fluctuations at audio band frequencies by injecting squeezed vacuum into a power stabilization setup.

LETTER

Laser-cooled $^{137}\mathrm{BaF}$ molecules for measuring nuclear-spin-dependent parity violation

Felix Kogel, Tatsam Garg, Marian Rockenhäuser, and Tim Langen

Phys. Rev. Research **7**, L022041 (2025) - Published 22 May, 2025



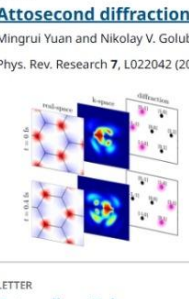
Many precision measurements with molecules require species that possess additional nuclear spin, but laser cooling such systems is challenging because of their complex hyperfine structure. This work develops and demonstrates laser-cooling strategies tailored to address these challenges.

LETTER

Attosecond diffraction imaging of electron dynamics in solids

Mingrui Yuan and Nikolay V. Golubev

Phys. Rev. Research **7**, L022042 (2025) - Published 27 May, 2025



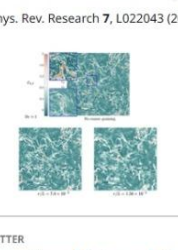
A theoretical approach is developed to simulate the time-resolved diffraction imaging (TRDI) of the light-driven electron dynamics in arbitrary periodic solid-state systems. It is demonstrated that the diffraction signal encodes key information about both the positions and momenta of the moving electrons, highlighting the potential of the TRDI as a powerful tool for investigating ultrafast quantum dynamics and electron transfer phenomena in solids.

LETTER

Extending Kolmogorov theory to polymeric turbulence

Alessandro Chiarini, Rahul K. Singh, and Marco E. Rosti

Phys. Rev. Research **7**, L022043 (2025) - Published 29 May, 2025



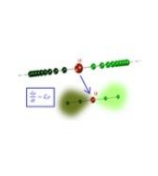
Polymeric turbulence can be reconciled with the classical Kolmogorov phenomenology by relying on an appropriate form of the Kármán-Howarth-Monin-Hill equation.

LETTER

Functional interpolation expansion for nonequilibrium correlated impurities

Daniel Werner and Enrico Arrigoni

Phys. Rev. Research **7**, L022044 (2025) - Published 29 May, 2025



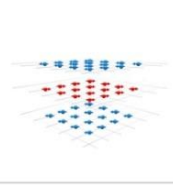
Functional interpolation provides an efficient and accurate approach to solving nonequilibrium quantum impurity problems in dynamical mean-field theory by modeling impurity dynamics using the Lindblad equation.

LETTER

Plane-selective manipulations of nuclear spin qubits in a three-dimensional optical tweezer array

Toshi Kusano, Yuma Nakamura, Rei Yokoyama, Naoya Ozawa, Kosuke Shibata, Tetsushi Takano, Yosuke Takasu, and Yoshiro Takahashi

Phys. Rev. Research **7**, L022045 (2025) - Published 30 May, 2025



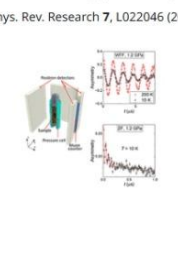
Leveraging the metastable $^3P_2$ state and a magnetic field gradient, this work experimentally demonstrates plane-selective manipulations of nuclear spin qubits in a three-dimensional optical tweezer array.

LETTER

Pressure effect on the spin density wave transition in $\mathrm{La}_2\mathrm{PrNi}_2\mathrm{O}_{6.96}$

Rustem Khasanov, Igor Plokhikh, Thomas J. Hicken, Hubertus Luetkens, Dariusz J. Gawryluk, and Zurab Guguchia

Phys. Rev. Research **7**, L022046 (2025) - Published 30 May, 2025



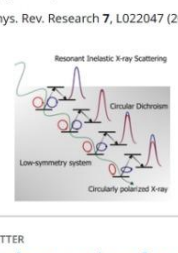
The magnetic response of the double-layer Ruddlesden-Popper nickelate La$_2$PrNi$_2$O$_{6.96}$ under hydrostatic pressure using muon-spin rotation and relaxation (μSR) measurements is investigated. The results show a gradual increase of the Néel temperature from 161 K at ambient pressure to 170 K at 2.3 GPa, while the ordered magnetic moment remains pressure independent. The pressure dependence of the magnetic order parameter follows a consistent power-law behavior across all measured pressures. These findings are compared with those of La$_3$Ni$_2$O$_7$, revealing that the magnetic properties are largely preserved upon partial Pr substitution.

LETTER

Circular dichroism in resonant inelastic x-ray scattering from birefringence in CuO

Abhishek Nag, Gérard Sylvester Perren, Hiroki Ueda, A. T. Boothroyd, D. Prabhakaran, M. García-Fernández, S. Agrestini, Ke-Jin Zhou, and Urs Staub

Phys. Rev. Research **7**, L022047 (2025) - Published 30 May, 2025



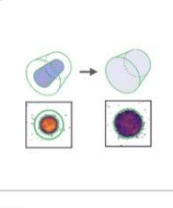
Soft x-ray resonant inelastic scattering is demonstrated to be influenced by birefringence in low-symmetry systems. This is exemplified by experiments using circularly polarized radiation on monoclinic CuO, where the occurrence and the energy and geometry dependent circular dichroism is well described by birefringence.

LETTER

Joule expansion of a quantum gas

Christopher J. Ho, Simon M. Fischer, Gevorg Martirosyan, Sebastian J. Morris, Jiří Etrych, Christoph Eigen, and Zoran Hadzibabic

Phys. Rev. Research **7**, L022048 (2025) - Published 2 June, 2025



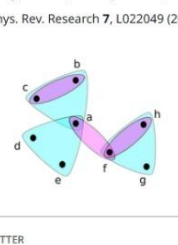
This work experimentally demonstrates the Joule expansion of a quantum gas and quantitatively explains the observed temperature changes arising from quantum statistics and interparticle interactions.

LETTER

Double explosive Kuramoto transition in hypergraphs

Sangita Dutta, Prosenjit Kundu, Pitambar Khanra, Ludovico Minati, Stefano Boccaletti, Pinaki Pal, and Chittaranjan Hens

Phys. Rev. Research **7**, L022049 (2025) - Published 2 June, 2025



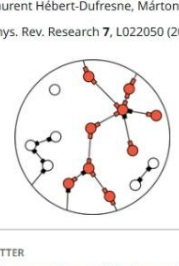
Researchers have gained new insights into double explosive transitions, revealing how a delicate interplay between higher-order interactions and a partially adapting global order parameter can trigger these dramatic shifts in both forward and backward directions. This discovery, numerically reinforced and confirmed by the Ott-Antonsen ansatz, paves the way for understanding complex synchronization transition phenomena across dynamical systems.

LETTER

Random graphs with specific degree distribution and giant component size

Laurent Hébert-Dufresne, Márton Pósfai, and Antoine Allard

Phys. Rev. Research **7**, L022050 (2025) - Published 3 June, 2025



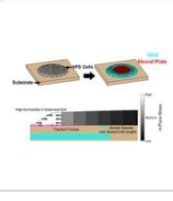
This paper introduces a critical constraint that looks at the giant component of a network in order to explore global features of a network. The model yields a simpler mathematical apparatus that compares favorably with known results.

LETTER

Generation of fate patterns via intercellular forces

Hayden Nunley, Xufeng Xue, Jianping Fu, and David K. Lubensky

Phys. Rev. Research **7**, L022051 (2025) - Published 4 June, 2025



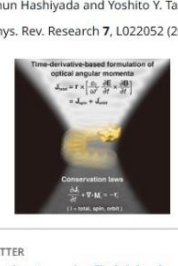
A model for the generation of a cell fate pattern via a coupling between mechanical stress and cell fate is presented. *In vitro* experiments validate a key model prediction that the size of the fate pattern's outer domain depends nonmonotonically on substrate stiffness.

LETTER

Conservation law for angular momentum based on optical field derivatives: Analysis of optical spin-orbit conversion

Shun Hashiyada and Yoshito Y. Tanaka

Phys. Rev. Research **7**, L022052 (2025) - Published 4 June, 2025



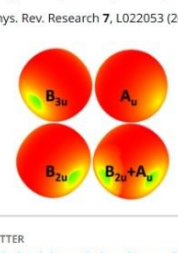
Using a gauge-invariant formalism based on time-derivative electromagnetic fields that incorporates longitudinal field components, this work derives separate conservation laws for spin and orbital angular momentum in matter-containing systems. This enables quantitative analysis of spin-orbit conversion through independent evaluation of angular momentum losses in light-matter interactions such as scattering and focusing.

LETTER

Anisotropic field-induced changes in the superconducting order parameter of UTe_2

Sangyun Lee, Andrew J. Woods, P. F. S. Rosa, S. M. Thomas, E. D. Bauer, Shi-Zeng Lin, and R. Movshovich

Phys. Rev. Research **7**, L022053 (2025) - Published 4 June, 2025



Magnetic-field-dependent heat capacity measurements are carried out on an ultrapure sample of the UTe$_2$ superconductor along different crystallographic directions. By analyzing the resulting field-dependent residual Sommerfeld coefficients, a case is made that B_{2u} is the primary superconducting order parameter in UTe$_2$.

LETTER

Global-local duality of energetic control cost in multipartite quantum correlated systems

Rui Guan, Junjie Liu, and Jian-Hua Jiang

Phys. Rev. Research **7**, L022054 (2025) - Published 5 June, 2025

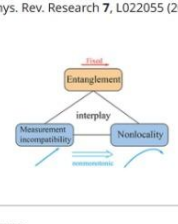
This work presents a global-local thermodynamic framework that uncovers universal structures in the thermodynamic cost of driving generic multipartite quantum correlated systems.

LETTER

Interplay of quantum resources in nonlocality tests

Hai-Hao Dong, Yuwei Zhu, Su-Yi Cheng, Xingjian Zhang, Cheng-Long Li, Ying-Zhao Li, Hao Li, Lixing You, Xiongfeng Ma, Qiang Zhang, and Jian-Wei Pan

Phys. Rev. Research **7**, L022055 (2025) - Published 5 June, 2025



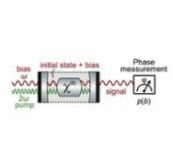
A study quantifies entanglement and measurement incompatibility with a loophole-free test of Bell inequality in experimental configurations. The work further uncovers an unexpected tripartite relationship: at fixed entanglement levels, enhanced measurement incompatibility initially amplifies nonlocality but ultimately induces its suppression.

LETTER

Quantum sensitivity of parametric oscillators

Alex Gu, Jamison Sloan, Charles Roques-Carmes, Seou Choi, Eric I. Rosenthal, Michael Horodynski, Yannick Salamin, Jelena Vučković, and Marin Soljačić

Phys. Rev. Research **7**, L022056 (2025) - Published 6 June, 2025



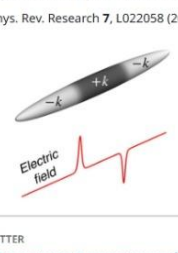
This work demonstrates that parametric oscillators exhibit high sensitivity to quantum initial conditions, showing how quantum statistics of arbitrary initial states influence macroscopic steady-state outcomes. The analytical theory linking initial quantum states to bistable probabilities is validated through both quantum and semiclassical simulations across optical parametric oscillators and Josephson junction-based superconducting circuits.

LETTER

Density-and-phase domain walls in a condensate with dynamical gauge potential

Sayak Bhattacharjee, Roderich Moessner, and Shovan Dutta

Phys. Rev. Research **7**, L022058 (2025) - Published 9 June, 2025



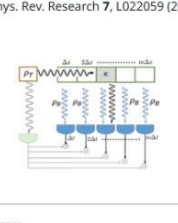
This work shows that by applying a gauge potential that varies smoothly with the particle density, one can stabilize domain walls in a Bose-Einstein condensate where synthetic electromagnetic fields are localized. The domain walls separate high- and low-density regions with opposite canonical momenta.

LETTER

Quantum target ranging for LiDAR

Giuseppe Ortolano and Ivano Ruo-Berchera

Phys. Rev. Research **7**, L022059 (2025) - Published 9 June, 2025



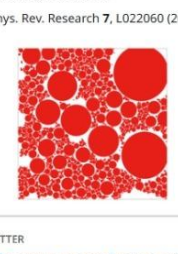
We show a quantum advantage in target ranging at a fixed source power in a new model suited for the optical range. We also find a quantitative connection between the performance of ranging and detection independent of the model.

LETTER

Self-organized criticality driven by droplet influx and random fusion

Bohan Lyu and Jie Lin

Phys. Rev. Research **7**, L022060 (2025) - Published 9 June, 2025



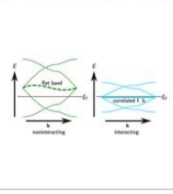
This study demonstrates how the addition of small droplets to a system leads to a self-organized critical state, where the droplet sizes follow a power-law distribution.

LETTER

Electron correlations in the kagome flat band metal $\mathrm{CsCr}_3\mathrm{Sb}_5$

Fang Xie, Yuan Fang, Ying Li, Yuefei Huang, Lei Chen, Chandan Setty, Shouvik Sur, Boris Yakobson, Roser Valentí, and Qimiao Si

Phys. Rev. Research **7**, L022061 (2025) - Published 10 June, 2025



A mechanism is advanced by which electron correlations drive an emergent flat band pinned at the Fermi level in a kagome metal. In particular, in the kagome compound CsCr$_3$Sb$_5$, this correlation effect primarily involves the Cr-d orbitals, even though the flat band induced by geometric destructive interference from these orbitals is away from the Fermi level in the noninteracting band structure.

LETTER

Photoinduced quenching of the $^{229}\mathrm{Th}$ isomer in a solid-state host

J. E. S. Terhune, R. Elwell, H. B. Tran Tan, U. C. Perera, H. W. T. Morgan, A. N. Alexandrova, Andrei Derevianko, and Eric R. Hudson

Phys. Rev. Research **7**, L022062 (2025) - Published 11 June, 2025

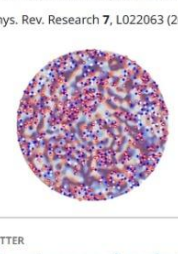
The laser-accessible ^{229}Th isomeric transition holds much promise for a solid-state nuclear timekeeping device of exquisite stability. This work demonstrates that this nuclear excited state, when embedded in a crystal, can be quenched by a laser detuned from the nuclear transition, and it discusses the impact on clock operations.

EDITORS' SUGGESTION LETTER

Topological pathways to two-dimensional quantum turbulence

R. Panico, G. Ciliberto, G. I. Martone, T. Congy, D. Ballarini, A. S. Lanotte, and N. Pavloff

Phys. Rev. Research **7**, L022063 (2025) - Published 11 June, 2025



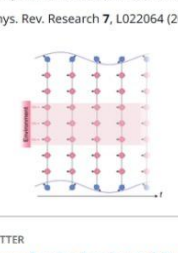
A joint theoretical and experimental investigation of a two-dimensional quantum fluid of exciton polaritons highlights the crucial role of topological conservation laws in both the growth and decay of turbulence.

LETTER

Quantum synchronization in one-dimensional topological systems

Tong Liu, Laura García-Álvarez, and Giovanna Tancredi

Phys. Rev. Research **7**, L022064 (2025) - Published 11 June, 2025



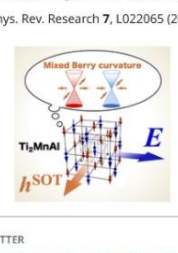
Local dissipation drives synchronized oscillations of edge states in one-dimensional topological systems. Both the oscillation amplitude and frequency remain stable in the thermodynamic limit and are robust to Hamiltonian perturbations and variations in the initial state.

LETTER

Topological spin-orbit torque in ferrimagnetic Weyl semimetal

Tomonari Meguro, Akihiro Ozawa, Koji Kobayashi, Yasufumi Araki, and Kentaro Nomura

Phys. Rev. Research **7**, L022065 (2025) - Published 12 June, 2025



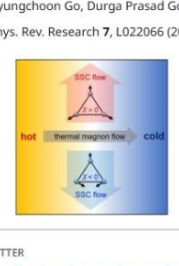
Calculations for the compensated ferrimagnetic Weyl semimetal Ti$_2$MnAl reveal a topological spin-orbit torque arising from the Weyl-point-induced mixed Berry curvature, defined in the composite parameter space of momentum and the magnetic order parameter. These findings highlight magnetic Weyl semimetals as promising low-dissipation platforms for electric control of magnetism

LETTER

Scalar spin chirality Nernst effect

Gyungchoon Go, Durga Prasad Goli, Nanse Esaki, Yaroslav Tserkovnyak, and Se Kwon Kim

Phys. Rev. Research **7**, L022066 (2025) - Published 12 June, 2025



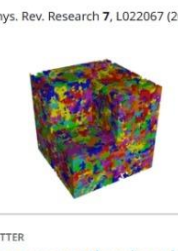
This work studies the transverse transport of the scalar spin chirality—a triple spin product characterizing noncoplanar spin structure. Using the linear response theory and micromagnetic simulations, this work demonstrates that the scalar spin chirality undergoes transverse thermal transport under an applied bias, constituting the scalar spin chirality Nernst effect.

LETTER

Unlimited number of spanning clusters in three-dimensional percolation above the critical point

Carlos G. L. Sousa, José S. Andrade, Jr., André A. Moreira, Cesar I. N. Sampaio Filho, Erika Eiser, Alex Hansen, and Hans J. Herrmann

Phys. Rev. Research **7**, L022067 (2025) - Published 16 June, 2025



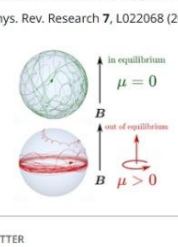
A three-dimensional percolation model is introduced that exhibits several simultaneously spanning clusters at and above the critical point. The maximal number of these spanning clusters grows logarithmically with system size, and all transitions are within the universality class of standard percolation.

LETTER

Paramagnetism in spherically confined charged active matter

Balázs Németh and Ronojoy Adhikari

Phys. Rev. Research **7**, L022068 (2025) - Published 17 June, 2025



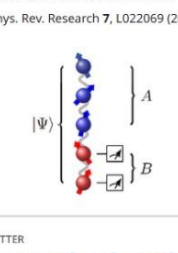
Statistical mechanics forbids the appearance of magnetism in a classical system of charges in thermal equilibrium. Using theory and simulations, this work shows that a paramagnetic response to an applied magnetic field can arise by confining a charged active particle to the surface of a sphere.

LETTER

Extracting randomness from magic quantum states

Christopher Vairogs and Bin Yan

Phys. Rev. Research **7**, L022069 (2025) - Published 20 June, 2025



A connection is found between the degree of nonstabilizerness, often known as magic, of a quantum state and the randomness of states produced by projective measurements on a subsystem. Quantum states possessing a greater degree of magic can produce a postmeasurement ensemble of states with a smaller deviation from uniform Haar randomness.

LETTER

Resonantly enhanced superconductivity mediated by spinor condensates

Giacomo Bighin, Puneet A. Murthy, Nicolò Defenu, and Tilman Enss

Phys. Rev. Research **7**, L022070 (2025) - Published 20 June, 2025

An unexpected resonance emerges when fermions interact through a spinor Bose-Einstein condensate poised at the brink of quantum criticality. This singular enhancement of mediated interactions increases superconducting pairing strengths, offering a pathway to enhance superconductivity in both semiconductor exciton-polaritons and ultracold quantum gases.

LETTER

Families of isospectral and isoscattering quantum graphs

Pavel Kurasov, Omer Farooq, Michał Ławniczak, Szymon Bauch, Mats-Erik Pistol, Matthew de Courcy-Ireland, and Leszek Sirko

Phys. Rev. Research **7**, L022071 (2025) - Published 20 June, 2025

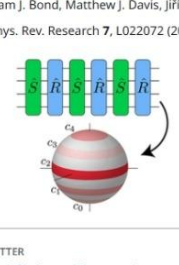
This work employs the concept of germ graphs and the M-function formalism to construct large families of isospectral and isoscattering graphs. The theoretical predictions are then validated experimentally by using microwave networks to emulate open quantum graphs with dissipation.

LETTER

Global variational quantum circuits for arbitrary symmetric state preparation

Liam J. Bond, Matthew J. Davis, Jiří Minář, Rene Gerritsma, Gavin K. Brennen, and Arghavan Safavi-Naini

Phys. Rev. Research **7**, L022072 (2025) - Published 20 June, 2025



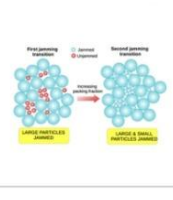
A variational quantum circuit comprised of layers of global spin squeezing and global rotations is presented that is optimal for synthesizing arbitrary symmetric states. Certain quantum error correction codewords and quantum metrology resource states require circuits of only a few layers, and the protocol can be readily realized in trapped ions.

LETTER

Additional jamming transition in two-dimensional bidisperse granular packings

Juan C. Petit and Matthias Sperl

Phys. Rev. Research **7**, L022073 (2025) - Published 20 June, 2025



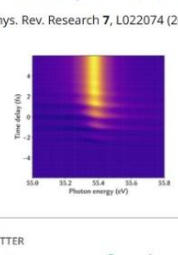
An investigation of the jamming behavior of bidisperse particle mixtures demonstrates that large particles jam at a lower packing fraction, while smaller particles remain unjammed until a higher density is reached, leading to a second jamming transition involving both species.

LETTER

Phase evolution of strong-field ionization

Lynda Hutcheson, Maximilian Hartmann, Gergana D. Borisova, Paul Birk, Shuyuan Hu, Christian Ott, Thomas Pfeifer, Hugo W. van der Hart, and Andrew C. Brown

Phys. Rev. Research **7**, L022074 (2025) - Published 24 June, 2025



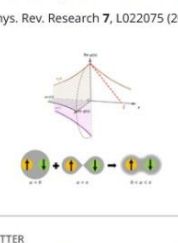
The time-dependent dipole phase shift during strong-field ionization of xenon is investigated using attosecond transient absorption spectroscopy. At intermediate intensities (~10^{14} Wcm^{-2}), interference between direct ionization, transient excitation, and polarization-induced population dynamics is identified, producing characteristic structures in the dipole response.

LETTER

Boson-anyon-fermion mapping and anyon construction in one dimension

Haitian Wang, Yu Chen, and Xiaoling Cui

Phys. Rev. Research **7**, L022075 (2025) - Published 25 June, 2025



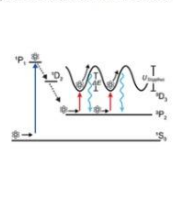
An exact mapping between short-range interacting 1D systems with arbitrary statistics is proved. The mapping facilitates anyon construction from a linear superposition of spatially symmetric and antisymmetric states.

LETTER

Narrow-line-mediated Sisyphus cooling in the $^3P_2$ metastable state of strontium

Chun-Chia Chen (陳俊嘉), Ryoto Takeuchi, Shoichi Okaba, and Hidetoshi Katori

Phys. Rev. Research **7**, L022076 (2025) - Published 25 June, 2025



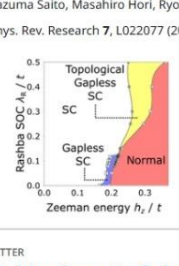
A new Sisyphus method for cooling strontium atoms while they are in an excited long-lived state is demonstrated. Traditionally, Doppler laser cooling combined with magnetic trapping is used to produce ultracold atoms for applications such as optical clocks and atom interferometers. Our approach enhances this process by introducing a periodic light field that reshapes the energy landscape of the excited state into a series of optical "speed bumps"—potential hills that cause atoms to lose kinetic energy as they move. This mechanism significantly accelerates the cooling process, reducing the time required by an order of magnitude. The result is more efficient continuous loading and outcoupling of atoms, both of which are critical for realizing next-generation continuous-wave optical clocks and superradiant lasers.

LETTER

Gapless superconductivity and its real-space topology in quasicrystals

Kazuma Saito, Masahiro Hori, Ryo Okugawa, K. Tanaka, and Takami Tohyama

Phys. Rev. Research **7**, L022077 (2025) - Published 25 June, 2025



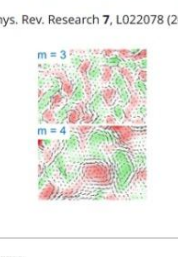
Gapless superconductivity of s-wave nature is shown to occur stably in two-dimensional quasicrystals because of the combination of intrinsic inhomogeneity and highly degenerate confined states that is unique to quasicrystals. In the presence of Rashba spin-orbit coupling, this gapless superconducting phase can be topologically nontrivial, and a pseudospectrum invariant given by a spectral localizer can signify its bulk topology and the existence of Majorana edge modes.

LETTER

Multiscale vortical phonons and vorticity wave vortices as coherent excitations in two-dimensional dusty plasma crystals

Wei-Shuo Lo, Chen-Yu Siao, Yi-Cheng Zhao, and Lin I

Phys. Rev. Research **7**, L022078 (2025) - Published 26 June, 2025



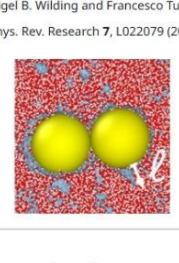
By analyzing thermal vibrations in two-dimensional dusty plasma and Yukawa and Lennard-Jones crystals, multiscale vortical phonons—propagating swirls—are uncovered as basic cooperative acoustic excitations. These vortical phonons (vorticity waves) host vorticity wave vortices, localized topological entities, where vorticity wave crests helically wind around screw dislocation filaments in space-time. The findings provide a new paradigm for characterizing thermally driven disordered wave systems.

LETTER

Origin of the inverse temperature dependence of hydrophobic attraction

Nigel B. Wilding and Francesco Turci

Phys. Rev. Research **7**, L022079 (2025) - Published 30 June, 2025



Using enhanced simulations, this work shows that the counterintuitive increase in hydrophobic attraction with rising temperature stems from the rapid thermal expansion of solvation shells around extended hydrophobic solutes. A morphometric theory links this behavior to a near-critical drying transition, providing a comprehensive quantitative explanation that challenges traditional assumptions about the role of hydrogen bonding.

ARTICLES

Strong-field-assisted x-ray second harmonic generation

Xinhua Xie (谢新华)

Phys. Rev. Research **7**, 023001 (2025) - Published 1 April, 2025

Performance of wave function and Green's function methods for non-equilibrium many-body dynamics

Cian C. Reeves, Gaurav Harsha, Avijit Shee, Yuanran Zhu, Thomas Blommel, Chao Yang, K. Birgitta Whaley, Dominika Zgid, and Vojtěch Vlček

Phys. Rev. Research **7**, 023002 (2025) - Published 1 April, 2025

Comparing kinetic proofreading and kinetic segregation for T cell receptor activation

Alexander S. Moffett, Kristina A. Ganzinger, and Andrew W. Eckford

Phys. Rev. Research **7**, 023003 (2025) - Published 1 April, 2025

Analytical study of the non-Hermitian semiclassical Rabi model

Yibo Liu, Liwei Duan, and Qing-Hu Chen

Phys. Rev. Research **7**, 023004 (2025) - Published 2 April, 2025

Symmetry, gauge freedoms, and the interpretability of sequence-function relationships

Anna Posfai, David M. McCandlish, and Justin B. Kinney

Phys. Rev. Research **7**, 023005 (2025) - Published 2 April, 2025

Probing electromagnetic nonreciprocity with quantum geometry of photonic states

Ioannis Petrides, Jonathan B. Curtis, Marie Wesson, Amir Yacoby, and Prineha Narang

Phys. Rev. Research **7**, 023006 (2025) - Published 2 April, 2025

Properties of the frustrated spin 1/2 kagome material $\mathrm{Cu}_3(\mathrm{HOTP})_2$

F. L. Pratt, D. López-Alcalá, V. García-López, M. Clemente-León, J. J. Baldoví, and E. Coronado

Phys. Rev. Research **7**, 023007 (2025) - Published 2 April, 2025

Reentrant phase behavior in binary topological flocks with nonreciprocal alignment

Tian Tang, Yu Duan, and Yu-qiang Ma

Phys. Rev. Research **7**, 023008 (2025) - Published 2 April, 2025

Large Nernst effect in Te-based van der Waals materials

M. Behnami, M. Gillig, A. G. Moghaddam, D. V. Efremov, G. Shipunov, B. R. Piening, I. V. Morozov, S. Aswartham, J. Dufouleur, K. Ochkan, J. Zemen, V. Kocsis, C. Hess, M. Putti, B. Büchner, F. Caglieris, and H. Reichlova

Phys. Rev. Research **7**, 023009 (2025) - Published 3 April, 2025

Glassy dynamics in deep neural networks: A structural comparison

Max Kerr Winter and Liesbeth M. C. Janssen

Phys. Rev. Research **7**, 023010 (2025) - Published 3 April, 2025