Volume 16, Issue 3

July - September 2026

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On the Cover

Characterizing living systems far from the thermodynamic limit can yield insight into the physics of nonreciprocity and biological self-organization.

From the article:

Topological Flowscape Reveals State Transitions in Nonreciprocal Living Matter
Hyunseok Lee, EliseAnne Koskelo, Shreyas Gokhale, Junang Li, Chenyi Fei, Chih-Wei Joshua Liu, Lisa Lin, Jörn Dunkel, Dominic J. Skinner, and Nikta Fakhri
Phys. Rev. X **16**, 031061 (2026)

Editorial: Physical Review X at Fifteen
Denis Bartolo and Brent Grocholski
Phys. Rev. X **16**, 030001 (2026) - Published 1 July, 2026

Editorial: Closing Special Collection on 2D Materials
Liuyan Zhao and Xavier Marie
Phys. Rev. X **16**, 030002 (2026) - Published 3 August, 2026

PERSPECTIVE
Vast World of Quantum Advantage
Hsin-Yuan Huang, Soonwon Choi, Jarrod R. McClean, and John Preskill
Phys. Rev. X **16**, 030501 (2026) - Published 9 July, 2026

Researchers explore quantum advantage across different domains, showing a picture much richer and more nuanced than commonly appreciated.

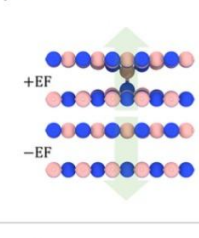
Universal Fault-Tolerant Quantum Computation in 2D without Getting Tied in Knots
Margarita Davydova, Andreas Bauer, Julio C. Magdalena de la Fuente, Mark Webster, Dominic J. Williamson, and Benjamin J. Brown
Phys. Rev. X **16**, 031001 (2026) - Published 7 July, 2026

Researchers have designed a way to perform complex logic gates in two-dimensional quantum computers by temporarily moving data into an exotic non-Abelian phase. This method provides a path toward large-scale, fault-tolerant quantum computation.

Agentic Exploration of Physics Models
Maximilian Nägele and Florian Marquardt
Phys. Rev. X **16**, 031002 (2026) - Published 8 July, 2026

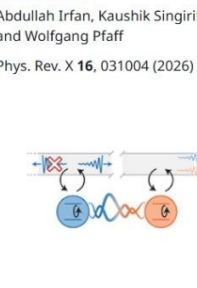
SCIEXPLORER, a generalist artificial scientist agent based on a large-language model, automates the process of scientific research and discovery and uncovers underlying models of diverse physical systems without task-specific fine-tuning.

Electric-Field Control of Interlayer Binding and Friction in h-BN Contacts
Penghua Ying, Michael Urbakh, and Oded Hod
Phys. Rev. X **16**, 031003 (2026) - Published 10 July, 2026



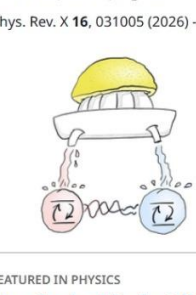
External electric fields can be used to control sliding resistance in layered materials, providing a way to control friction in some systems.

FEATURED IN PHYSICS
Autonomous Stabilization of Remote Entanglement in a Cascaded Quantum Network
Abdullah Irfan, Kaushik Singirikonda, Mingxing Yao, Andrew Lingenfelter, Michael Mollenhauer, Xi Cao, Aashish A. Clerk, and Wolfgang Pfaff
Phys. Rev. X **16**, 031004 (2026) - Published 13 July, 2026



Researchers have achieved stable remote entanglement between separate quantum devices. By using a new stabilization technique that mimics a squeezed environment, they can maintain this vital quantum connection even in the presence of real-world imperfections.

FEATURED IN PHYSICS
Distributing Stationary Qubit Entanglement through a Nonlocal Squeezed Reservoir
A. Andrés-Juanes, J. Agustí, R. Sett, E. S. Redchenko, L. N. Kapoor, S. Hawaldar, P. Rabl, and J. M. Fink
Phys. Rev. X **16**, 031005 (2026) - Published 13 July, 2026

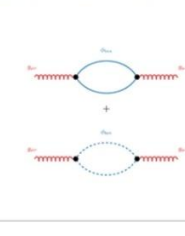


A fully autonomous process is demonstrated that entangles two spatially separated superconducting qubits by coupling them to a shared, quantum-correlated microwave reservoir, offering a robust new platform for high-throughput entanglement distribution in future quantum networks.

FEATURED IN PHYSICS
Topological Defect Propagation to Classify Knitted Fabrics
Daisuke S. Shimamoto, Keiko Shimamoto, Sonia Mahmoudi, and Samuel Poincloux
Phys. Rev. X **16**, 031006 (2026) - Published 14 July, 2026

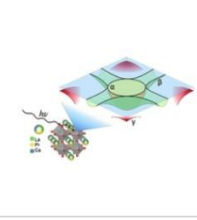
The ability of a fabric to be knitted into a textile can be determined on the basis of the topology of its pattern.

Covariant Path Integrals for Quantum Fields Backreacting on Classical Space-Time
Jonathan Oppenheim and Zachary Weller-Davies
Phys. Rev. X **16**, 031007 (2026) - Published 15 July, 2026



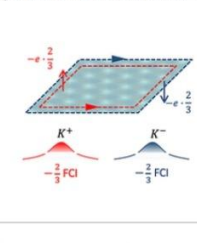
Researchers have developed a mathematical framework to bridge the gap between Einstein's classical gravity and quantum mechanics. Their theory allows matter to remain quantum while space-time stays classical, offering a way to test if space and time truly require a quantum explanation.

Electronic Structure of Compressively Strained Bilayer Nickelate Thin Film
Bai Yang Wang, Sebastien N. Abadi, Yidi Liu, Yu Zhang, Yong Zhong, Yijun Yu, Berit H. Goodge, Xiaoliang Zhang, Yi-Ming Wu, Ruohan Wang, Jiarui Li, Yaoju Tarn, Eun Kyo Ko, Vivek Thampy, Chun Lin, Makoto Hashimoto, Donghui Lu, Young S. Lee, Thomas P. Devereaux, Chunjing Jia, Harold Y. Hwang, and Zhi-Xun Shen
Phys. Rev. X **16**, 031008 (2026) - Published 15 July, 2026



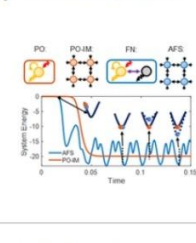
Angle-resolved photoemission spectroscopy of bilayer nickelate thin films reveals that the out-of-plane nickel orbital band shifts with strain and doping but is not required at the Fermi level for superconductivity.

FEATURED IN PHYSICS
Candidate for a Fractional Topological Insulator in Twisted
Yiping Wang, Gillian E. Minarik, Weijie Li, Yves Kwan, Shuai Yuan, Eric Anderson, Chaowei Hu, Julian Ingham, Jeongheon Choe, Takashi Taniguchi, Kenji Watanabe, Xavier Roy, Jiun-Haw Chu, Raquel Queiroz, James C. Hone, N. Regnault, Xiaodong Xu, and Xiaoyang Zhu
Phys. Rev. X **16**, 031009 (2026) - Published 16 July, 2026



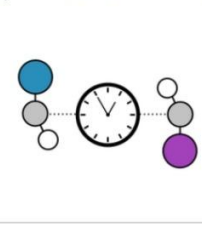
Pump-probe modulation spectroscopy of a MoTe bilayer superlattice reveals an out-of-plane antiferromagnetic response, providing experimental signatures of a putative fractional topological insulator state.

Floquet-Based Ising Machines Escape Local Minima in QUBO Problems
Nicolas Casilli, Seunghwi Kim, Sunil Mittal, Marvin Onabajo, Andrea Alù, and Cristian Cassella
Phys. Rev. X **16**, 031010 (2026) - Published 17 July, 2026



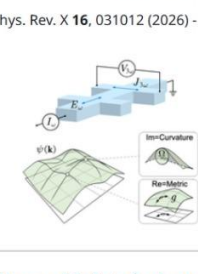
The analog Floquet solver incorporates Floquet amplitude modulations to help it escape local minima, significantly improving the accuracy of parametric oscillator-based Ising machines in solving optimization problems.

FEATURED IN PHYSICS
Engineered Molecular Clock Transitions for Precision Measurements
Yuiki Takahashi, Harish D. Ramachandran, Arian Jadbabaie, Yi Zeng, Chi Zhang, and Nicholas R. Hutzler
Phys. Rev. X **16**, 031011 (2026) - Published 20 July, 2026



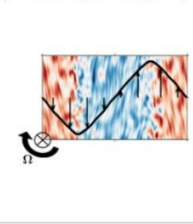
Special clock transitions in heavy polar molecules have been engineered to probe physics beyond the standard model, suppressing disruptive electromagnetic noise by orders of magnitude while preserving high sensitivity.

Identifying Geometric Third-Order Nonlinear Transport in Disordered Materials
Zhen-Hao Gong, Zhi-Hao Wei, Hai-Zhou Lu, and X. C. Xie
Phys. Rev. X **16**, 031012 (2026) - Published 21 July, 2026



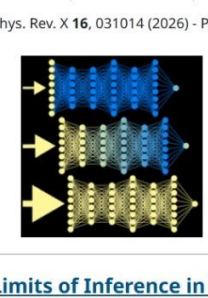
A theoretical data-analysis tool resolves the chaotic interpretation of nonlinear electronic transport data, providing a structured method to extract quantum geometric properties from realistic materials.

Waves Maintain Large-Scale 2D Flows in Rotating Turbulence and Cause Their Demise
Sébastien Gomé and Anna Frishman
Phys. Rev. X **16**, 031013 (2026) - Published 21 July, 2026



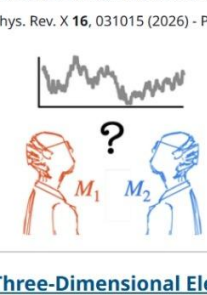
A first-principles approach helps explain energy transfer from 3D wave excitation to 2D structures in rotating turbulent flow.

Statistical Physics of Deep Learning: Optimal Learning of a Multilayer Perceptron near Interpolation
Jean Barbier, Francesco Camilli, Minh-Toan Nguyen, Mauro Pastore, and Rudy Skerk
Phys. Rev. X **16**, 031014 (2026) - Published 22 July, 2026



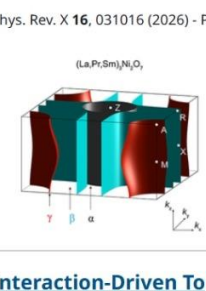
Using statistical physics and random matrix theory, researchers derive the generalization error of a deep fully connected neural network and uncover the mechanisms governing its behavior as feature learning progressively propagates across layers.

Limits of Inference in Complex Systems: When Stochastic Models Become Indistinguishable
Javier Aguilar, Miguel A. Muñoz, and Sandro Azaele
Phys. Rev. X **16**, 031015 (2026) - Published 23 July, 2026



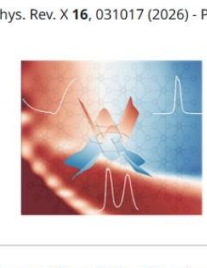
A path-inference framework quantifies data resolution limits that render distinct stochastic models empirically indistinguishable and offers guidelines for designing experimental measurements that maximize information extraction.

Three-Dimensional Electronic Structures in Superconducting Ruddlesden-Popper Bilayer Nickelate Films
Yueying Li, Lizhi Xu, Wei Lv, Zihao Nie, Zechao Wang, Yu Miao, Jianchang Shen, Guangdi Zhou, Wenhua Song, Heng Wang, Haoliang Huang, Junfeng He, Jin-Feng Jia, Peng Li, Qi-Kun Xue, and Zhuoyu Chen
Phys. Rev. X **16**, 031016 (2026) - Published 24 July, 2026



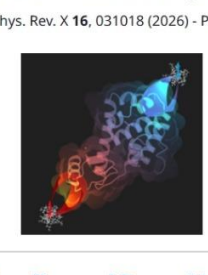
Angle-resolved photoemission spectroscopy of superconducting bilayer nickelate thin films reveals an intrinsic three-dimensional electronic structure and a strong-coupling pairing regime on the orbital band.

Interaction-Driven Topological Transitions in Monolayer
Jiangxu Li, Jian Tang, Cheng Xu, Louis Primeau, Thomas Siyuan Ding, Rahul Soni, Tiema Qian, Kenji Watanabe, Takashi Taniguchi, Ni Ni, Adrian Del Maestro, Qiong Ma, and Yang Zhang
Phys. Rev. X **16**, 031017 (2026) - Published 24 July, 2026



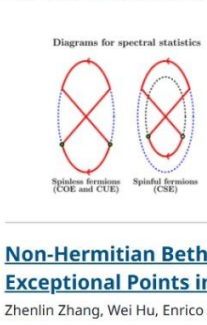
Theoretical and experimental mapping of monolayer TaIrTe reveals a rich landscape of interaction-driven topological phases on a single naturally layered crystal—no moiré engineering required.

Long-Lived Mechanically Detected Molecular Spins for Quantum Sensing
Sahand Tabatabaei, Pritam Priyadarsi, Daniel Tay, Namanish Singh, Pardis Sahafi, Andrew Jordan, and Raffi Budakian
Phys. Rev. X **16**, 031018 (2026) - Published 27 July, 2026



Researchers integrate molecular spins with mechanical readout to detect nanotesla magnetic fields and resolve local nuclear spectra.

Leading and Beyond Leading-Order Spectral Form Factor in Chaotic Quantum Many-Body Systems Across All Dyson Symmetry Classes
Vijay Kumar, Tomaž Prosen, and Dibyendu Roy
Phys. Rev. X **16**, 031019 (2026) - Published 27 July, 2026



Researchers analytically calculate the spectral form factor up to second order in time for chaotic many-body systems across all Dyson symmetry classes.

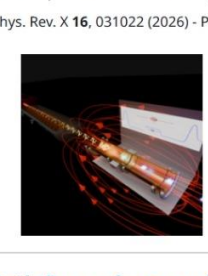
Non-Hermitian Bethe-Salpeter Equation for Open Systems: Emergence of Exceptional Points in Excitonic Spectra from First Principles
Zhenlin Zhang, Wei Hu, Enrico Perfetto, and Gianluca Stefanucci
Phys. Rev. X **16**, 031020 (2026) - Published 28 July, 2026

Extension of the Bethe-Salpeter equation to open quantum systems predicts that engineered photonic environments induce exceptional points in the excitonic spectra of transition-metal dichalcogenides, providing a pathway for non-Hermitian quantum devices with controllable optical and valleytronic properties.

Predicting Liquid Properties and Behavior via Droplet Pinch-off and Machine Learning
Jingtao Wang, Qiwei Chen, C. Ricardo Constante-Amores, Denise Gorse, Alfonso Arturo Castrejón-Pita, and José Rafael Castrejón-Pita
Phys. Rev. X **16**, 031021 (2026) - Published 29 July, 2026

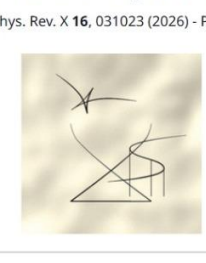
A powerful method allows hard to measure properties like viscosity and surface tension to be determined from a single, high-speed snapshot.

Deceleration of Accelerator-Produced and In-Trap Electron Cooling of Highly Charged Ions
S. Rausch, Z. Andelkovic, S. Fedotova, W. Geithner, F. Herfurth, M. Horst, J. Ködel, K. Mohr, D. Neidherr, W. Nörtershäuser, N. Stallkamp, S. Trotsenko, G. Vorobjev, and D. Zisis
Phys. Rev. X **16**, 031022 (2026) - Published 29 July, 2026



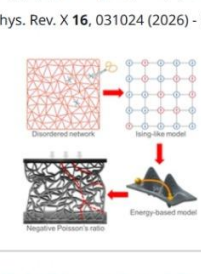
The electron cooling of highly charged ions (HCI) in a Penning trap, as well as the deceleration and trapping of accelerator-produced HCI, has been demonstrated at the HITRAP facility, paving the way for unprecedented precision experiments in QED, materials science, and astrophysics.

Path-Dependency and Emergent Computing under Vectorial Driving
C. M. Meulblok, A. Singh, M. Labousse, and M. van Hecke
Phys. Rev. X **16**, 031023 (2026) - Published 30 July, 2026



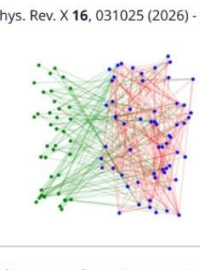
A general framework unravels path dependencies across a wide range of driven complex materials.

FEATURED IN PHYSICS
Unlocking Emergent Resilience in Amorphous Metamaterials via a Physics-Constrained Energy-Based Framework
Lingyu Jia, Changliang Zhu, Qiaozhi Lei, Hua Tong, Jinkui Meng, Chengyan Xu, Xiangying Shen, and Lei Xu
Phys. Rev. X **16**, 031024 (2026) - Published 31 July, 2026



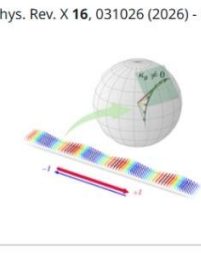
A physics-constrained design framework may aid the search for lightweight but resilient material.

High-Dimensional Dynamics in Low-Dimensional Networks
Yue Wan and Robert Rosenbaum
Phys. Rev. X **16**, 031025 (2026) - Published 3 August, 2026



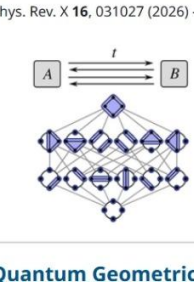
The relationship between the dimensionality of a network's structure and its dynamics is investigated, showing that networks with low-dimensional structures can produce either high- or low-dimensional responses.

Riemannian Geometric Classification and Emergent Phenomena of Magnetic Textures
Koki Shinada and Naoto Nagaosa
Phys. Rev. X **16**, 031026 (2026) - Published 4 August, 2026



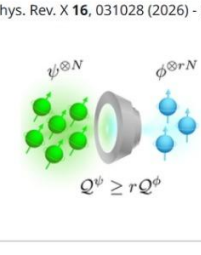
A classification framework based on differential geometry introduces geodesic and torsional scalar spin chiralities, revealing a quantum geometric effect that modifies electron equations of motion in complex magnetic textures.

Free Probability in a Minimal Quantum Circuit Model
Felix Fritzsch and Pieter W. Claeys
Phys. Rev. X **16**, 031027 (2026) - Published 5 August, 2026



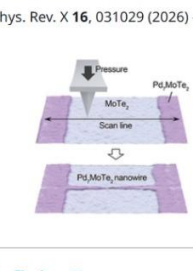
Researchers characterize out-of-time-order correlation functions in a quantum circuit model, mapping system-bath interactions to free probability structures.

Quantum Geometric Tensor Determines the Pure-State I.I.D. Conversion Rate in the Resource Theory of Asymmetry for Any Compact Lie Group
Koji Yamaguchi, Yosuke Mitsuhashi, Tomohiro Shitara, and Hiroyasu Tajima
Phys. Rev. X **16**, 031028 (2026) - Published 5 August, 2026



Researchers prove that the quantum geometric tensor completely dictates pure-state asymptotic conversion rates under any compact Lie group symmetry.

Mechanochemical Nano-Writing of an Atomically Thin Metal
Shuai Zhang, Yanyu Jia, Atanu Samanta, Yutian Bao, Haosen Guan, Zhaoyi Joy Zheng, Guangming Cheng, Ting Liu, Cangyu Qu, Kenji Watanabe, Takashi Taniguchi, Nan Yao, Ashlie Martini, Leslie Schoop, Andrew M. Rappe, Sanfeng Wu, and Robert W. Carpick
Phys. Rev. X **16**, 031029 (2026) - Published 6 August, 2026



A large stress generated by a small tip drives a reaction between two materials in an 2D encapsulated space to produce a new material with interesting electronic properties that can be written into patterns as small as 50 nm.

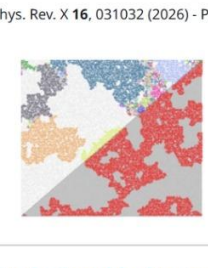
Infinite Temperature at Zero Energy
Matteo Ippoliti and David M. Long
Phys. Rev. X **16**, 031030 (2026) - Published 7 August, 2026

Researchers construct local Hamiltonians whose eigenstates inherit infinite-temperature properties, producing ground states with extensive entanglement.

Observation of Correlated Plasmons in Low-Valence Nickelates
Y. Shen, W. He, J. Sears, Xuefei Guo, Xiangpeng Luo, A. Roll, J. Li, J. Pelliciari, Xi He, I. Božović, Junjie Zhang, J. F. Mitchell, V. Bisogni, M. Mitrano, S. Johnston, and M. P. M. Dean
Phys. Rev. X **16**, 031031 (2026) - Published 7 August, 2026

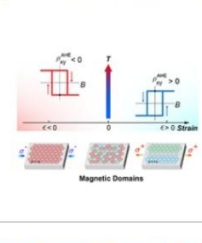
Resonant inelastic x-ray scattering measurements reveal propagating plasmons in the low-valence nickelate PrNiO with dynamics distinct from those of cuprate superconductors.

Fast Algorithm for 2D Rigidity Percolation
Nina Javerzat and Daniele Notarmuzi
Phys. Rev. X **16**, 031032 (2026) - Published 10 August, 2026



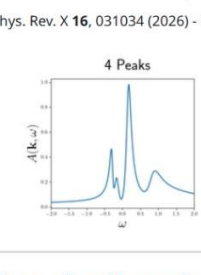
An algorithm for simulating the rigidity percolation transition, based on novel theoretical results, overcomes previous size limitations and enables the highly precise characterization of its universality classes, shedding new light on rigidity transitions in amorphous systems.

Strain-Tunable Anomalous Hall Effect in Hexagonal MnTe
Zhaoyu Liu, Sijie Xu, Jonathan M. DeStefano, Elliott Rosenberg, Tingjun Zhang, Jinyulin Li, Matthew B. Stone, Feng Ye, Wei Tian, Sarah Edwards, Rong Cong, Siyu Pan, Ching-Wu Chu, Liangzi Deng, Emilia Morosan, Rafael M. Fernandes, Jiun-Haw Chu, and Pengcheng Dai
Phys. Rev. X **16**, 031033 (2026) - Published 11 August, 2026



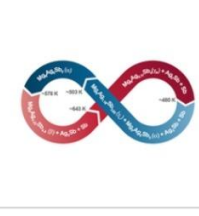
Uniaxial strain applied to the hexagonal altermagnet isolates a single magnetic domain, revealing a sharp anomalous Hall effect and a sign reversal driven by modifications to the electronic Berry curvature.

Pseudogap, Fermi Liquid, Van Hove Singularity, and Maxima of the Compressibility and of the Knight Shift as a Function of Doping in the Two-Dimensional Hubbard Model
Y. M. Vilk and A.-M. S. Tremblay
Phys. Rev. X **16**, 031034 (2026) - Published 11 August, 2026



Analysis of Hubbard model simulations reveals that a maximum in the isothermal compressibility marks the pseudogap boundary, driven by spin-density-wave precursor bands crossing the zero-frequency level.

Unraveling Non-polymorphic Phase Evolution in Mg-Ag-Sb for Designing Thermally Recoverable Thermoelectrics
Shizhen Zhi, Xiaojing Ma, Shanghao Chen, Tianyu Zhang, Yao Xu, Jiang Chen, Sheng Ye, Chenhao Lin, Linmao Wen, Jinxuan Cheng, Rongpei Shi, Xingjun Liu, Feng Cao, Lijun Zhang, Yuhao Fu, Qian Zhang, and Jun Mao
Phys. Rev. X **16**, 031035 (2026) - Published 12 August, 2026

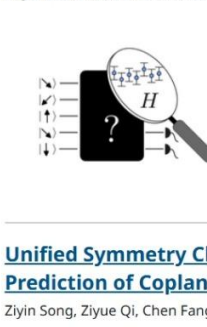


Thermal degradation in MgAgSb thermoelectric material can be reversed with low-temperature annealing.

Evolution of Polycrystallinity in Homogeneously Nucleated Colloidal Crystals
Merin Jose, Nicholas H. P. Orr, Taiki Yanagishima, and Roel P. A. Dullens
Phys. Rev. X **16**, 031036 (2026) - Published 12 August, 2026

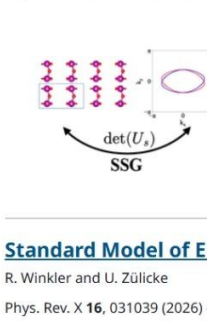
Direct observations of the birth and growth of polycrystalline colloidal crystals clarify the role of grain formation, a key aspect in understanding and tuning the properties of polycrystalline materials.

Bounded-Error Quantum Simulation via Hamiltonian and Lindbladian Learning
Tristan Kraft, Manoj K. Joshi, William T. Lam, Tobias Olsacher, Florian Kranzl, Johannes Franke, Lata Kh Joshi, Rainer Blatt, Augusto Smerzi, Daniel Stilck França, Benoît Vermersch, Barbara Kraus, Christian F. Roos, and Peter Zoller
Phys. Rev. X **16**, 031037 (2026) - Published 13 August, 2026



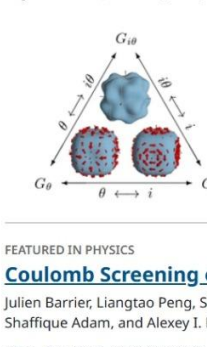
Researchers introduce a framework that infers quantum dynamics and error bounds from experimental data to validate large-scale quantum simulations.

Unified Symmetry Classification of Magnetic Orders via Spin Space Groups: Prediction of Coplanar Even-Wave Phases
Ziyin Song, Ziyue Qi, Chen Fang, Zhong Fang, and Hongming Weng
Phys. Rev. X **16**, 031038 (2026) - Published 13 August, 2026



A unified classification framework based on spin space group symmetry predicts a coplanar even-wave magnetic phase where electronic band spin polarization varies continuously and can vanish without band degeneracy.

Standard Model of Electromagnetism and Chirality in Crystals
R. Winkler and U. Zülicke
Phys. Rev. X **16**, 031039 (2026) - Published 17 August, 2026



A comprehensive symmetry-based classification identifies 12 fundamentally distinct types of crystal structures across five polar and five chiral categories, providing a complete taxonomy to predict and engineer next-generation multifunctional materials.

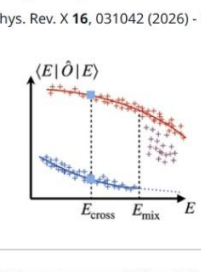
FEATURED IN PHYSICS
Coulomb Screening of Superconductivity in Magic-Angle Graphene
Julien Barrier, Liangtao Peng, Shuigang Xu, Christophe De Beule, V. I. Fal'ko, K. Watanabe, T. Taniguchi, A. K. Geim, Shaffique Adam, and Alexey I. Berdyugin
Phys. Rev. X **16**, 031040 (2026) - Published 17 August, 2026

Metallic layers placed near magic-angle graphene suppress Coulomb interactions and reveal that its superconductivity is driven by electronic interactions rather than conventional atomic vibrations.

Bulklike Costless Domain Walls Driven by Phonon Pair Condensation in
Hyun-Jae Lee, Pawan Kumar, Kyoung-June Go, Chang Hoon Kim, Yungyeom Kim, Kyoungjun Lee, Takao Shimizu, Seung Chul Chae, Hosub Jin, Minseong Lee, Umesh Waghmare, Si-Young Choi, and Jun Hee Lee
Phys. Rev. X **16**, 031041 (2026) - Published 18 August, 2026

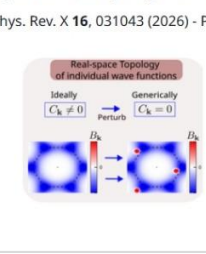
A previously unrecognized governing principle helps to explain the stable electrical properties in some ferroelectric materials like hafnium oxide.

Eigenstate Thermalization in Thermal First-Order Phase Transitions
Maksym Serbyn, Alexander Avdoshkin, Oriana K. Diessel, and David A. Huse
Phys. Rev. X **16**, 031042 (2026) - Published 18 August, 2026



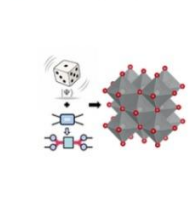
Researchers demonstrate that thermal first-order phase transitions require a generalization of the eigenstate thermalization hypothesis, leading to the coexistence of distinct eigenstate classes and Schrödinger-cat-like states.

Robustness of Real-Space Topology in Moiré Systems
Kryštof Kolář, Kang Yang, Felix von Oppen, and Christophe Mora
Phys. Rev. X **16**, 031043 (2026) - Published 19 August, 2026



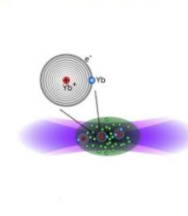
Topological analysis of real-space electronic textures in nonidealized moiré systems establishes a robust band index and maps wave functions onto a texturally derived fictitious magnetic field.

Ab Initio Auxiliary-Field Quantum Monte Carlo in the Thermodynamic Limit
Jinghong Zhang, Meng-Fu Chen, Adam Rettig, Tong Jiang, Paul J. Robinson, Hieu Q. Dinh, Anton Z. Ni, and Joonho Lee
Phys. Rev. X **16**, 031044 (2026) - Published 19 August, 2026



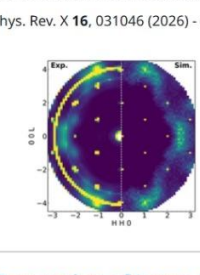
A low-scaling auxiliary-field quantum Monte Carlo method enables accurate simulations of real quantum materials, bridging the gap between benchmark many-body models and complex solid-state systems.

Revealing Electron-Ytterbium Interactions through Rydberg Molecular Spectroscopy
Tangi Legrand, Xin Wang, Florian Pausewang, Wolfgang Alt, Eduardo Uruñuela, Sebastian Hofferberth, Milena Simić, and Matthew T. Eiles
Phys. Rev. X **16**, 031045 (2026) - Published 20 August, 2026



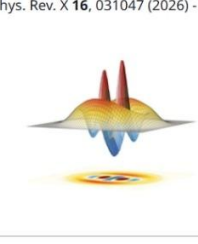
Precision spectroscopy of giant ytterbium Rydberg molecules provides a powerful new window into fundamental atomic properties, laying essential groundwork for future experiments with divalent atoms.

Phonon-Activated Collective Hopping in a Superionic Phase
Hung-Min Lin, Mayanak K. Gupta, Niuchang Ouyang, Tyler Wilson, Artem Pogodin, Md Towhidur Rahman, Alexandra Zevalkink, J. Ross Stewart, Fanni Juranyi, Tao Hong, Yan Wu, Songxue Chi, Douglas L. Abernathy, and Olivier Delaire
Phys. Rev. X **16**, 031046 (2026) - Published 21 August, 2026



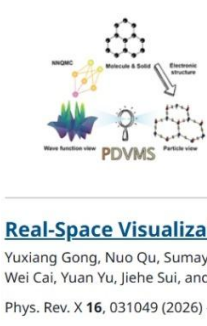
Observations of collective hopping in superionic agyrodites improves the microscopic understanding of transport in these materials.

Generation of Large Coherent-State Superpositions in Free-Space Optical Pulses
Lucas Caron, Hector Simon, Hugo Basset, Romaric Journet, and Rosa Tualle-Brouri
Phys. Rev. X **16**, 031047 (2026) - Published 21 August, 2026



Researchers generate large-amplitude optical cat states in free space, establishing a vital building block for fault-tolerant quantum computing.

Particle View of Many-Body Electronic Structure with Neural Network Wave Function
Zichen Wang, Weizhong Fu, Zhe Li, Weiluo Ren, and Ji Chen
Phys. Rev. X **16**, 031048 (2026) - Published 24 August, 2026



A combination of theoretical approaches bridges the gap between complex quantum wave functions and the classical picture of electron positions for molecules and solids.

Real-Space Visualization of the Intrinsic Aging in -type Thermoelectrics
Yuxiang Gong, Nuo Qu, Sumayya, Yu-Ke Zhu, Jianbo Zhu, Tinglu Song, Qianru Lin, Lankun Wang, Ran Xin, Fengkai Guo, Wei Cai, Yuan Yu, Jiehe Sui, and Zihang Liu
Phys. Rev. X **16**, 031049 (2026) - Published 24 August, 2026

Spontaneous degradation of an Mg(Sb,Bi) thermoelectric demonstrates intrinsic defect relaxations rather than external stimuli can govern long-timescale property evolution.

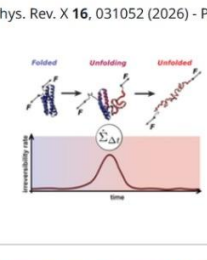
Semidefinite Block-Matrix Relaxations for Computing Quantum Correlations
Nicola D'Alessandro, Carles Roch i Carceller, and Armin Tavakoli
Phys. Rev. X **16**, 031050 (2026) - Published 25 August, 2026

Researchers provide a computational method for bounding the correlations arising in a multitude of quantum information problems.

Demonstrating Coherent Quantum Routers for Bucket-Brigade Quantum Random Access Memory on a Superconducting Processor
Sheng Zhang, Yun-Jie Wang, Peng Wang, Ren-Ze Zhao, Xiao-Yan Yang, Ze-An Zhao, Tian-Le Wang, Hai-Feng Zhang, Zhi-Fei Li, Yuan Wu, Hao-Ran Tao, Liang-Liang Guo, Lei Du, Chi Zhang, Zhi-Long Jia, Wei-Cheng Kong, Zhuo-Zhi Zhang, Xiang Song, Yu-Chun Wu, Zhao-Yun Chen, Peng Duan, and Guo-Ping Guo
Phys. Rev. X **16**, 031051 (2026) - Published 25 August, 2026

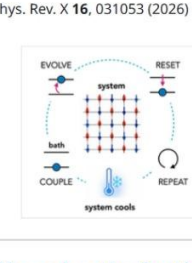
Researchers demonstrate coherent quantum routers on a superconducting processor to realize resilient routing for quantum memories.

Experimentally Accessible Measurement of Irreversibility in Stochastic Systems by Categorizing Single-Molecule Displacements
Alvaro Lanza, Inés Martínez-Martín, Rafael Tapia-Rojo, and Stefano Bo
Phys. Rev. X **16**, 031052 (2026) - Published 26 August, 2026



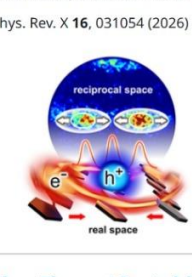
A model-free method that infers irreversibility directly from single-molecule position recordings offers a versatile and accessible tool to characterize the nonequilibrium behavior of small, time-dependent, continuous systems.

Quantum Thermal State Preparation for Near-Term Quantum Processors
Jerome Lloyd and Dmitry A. Abanin
Phys. Rev. X **16**, 031053 (2026) - Published 28 August, 2026



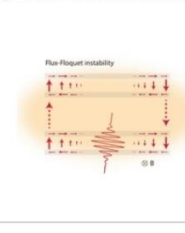
Researchers develop an algorithm that prepares many-body quantum thermal states accurately by combining bath resetting and modulated coupling.

Observing the Spatial and Temporal Evolution of Exciton Wave Functions in Organic Semiconductors
Marcel Theilen, Siegfried Kaidisch, Monja Stettner, Sarah Zajusch, Eric Fackelman, Alexa Adamkiewicz, Robert Wallauer, Andreas Windischbacher, Christian S. Kern, Michael G. Ramsey, François C. Bocquet, Serguei Soubatch, F. Stefan Tautz, Ulrich Höfer, and Peter Puschnig
Phys. Rev. X **16**, 031054 (2026) - Published 28 August, 2026



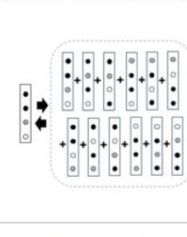
Femtosecond time-resolved photoemission orbital tomography tracks photoelectron profiles to reconstruct the real-space distribution and internal quantum phase of excitons in an organic semiconductor.

Flux-Floquet Instability in Fluctuating Superconductors
Marios H. Michael, Duilio De Santis, Eugene A. Demler, and Patrick A. Lee
Phys. Rev. X **16**, 031055 (2026) - Published 31 August, 2026



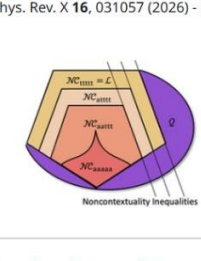
Intense terahertz light triggers a flux-Floquet instability in high-temperature superconductors, generating a giant magnetic response that reveals bound electron pairs survive well above the superconducting transition temperature.

Low-Depth Quantum Symmetrization
Zhenning Liu, Andrew M. Childs, and Daniel Gottesman
Phys. Rev. X **16**, 031056 (2026) - Published 31 August, 2026



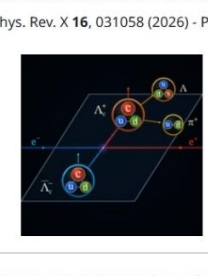
Researchers develop low-depth quantum symmetrization algorithms that enable efficient bosonic simulations, low-depth Dicke state preparation, and multiphoton interferometric imaging.

Entanglement Certification Using Noncontextuality Inequalities
Yujie Zhang, Jonah Spodek, David Schmid, Carter Reid, Liam J. Morrison, Thomas Jennewein, Kevin J. Resch, and Robert W. Spekkens
Phys. Rev. X **16**, 031057 (2026) - Published 1 September, 2026



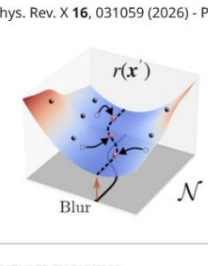
Researchers demonstrate a gauge-independent entanglement certification method based on noncontextuality inequalities that detects entangled states without requiring prior measurement device characterization.

Production and Decay Dynamics of the Charmed Baryon in Annihilations near Threshold
M. Ablikim *et al.* (BESIII Collaboration)
Phys. Rev. X **16**, 031058 (2026) - Published 4 September, 2026



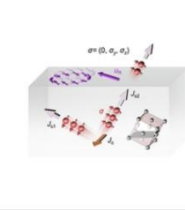
Researchers observe the transverse polarization of the charmed baryon in electron-positron annihilations using the BESIII detector.

Removing Nodal and Support-Mismatch Pathologies in Variational Monte Carlo via Blurred Sampling
Zhou-Quan Wan, Roeland Wiersema, and Shiwei Zhang
Phys. Rev. X **16**, 031059 (2026) - Published 2 September, 2026



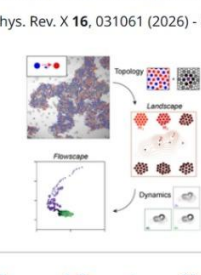
A Monte Carlo postprocessing method called blurred sampling eliminates infinite variance and systematic bias in variational quantum many-body simulations.

FEATURED IN PHYSICS
Ultrastrong Unconventional Spin Current via Noncollinear Spin-Orbit Filtering
Hongliang Chen, Zi-An Wang, Xingguo Gao, Hang Zhou, Jiaxin Chen, Chang Pan, Lizhu Ren, Qia Shen, Zhenyi Zheng, Dandan Guan, Xiaoxue Liu, Shiyong Wang, Yaoyi Li, Hao Zheng, Canhua Liu, Yumeng Yang, Xuepeng Qiu, Guowei Zhou, Jingsheng Chen, Jinfeng Jia, Ding-Fu Shao, and Liang Liu
Phys. Rev. X **16**, 031060 (2026) - Published 3 September, 2026



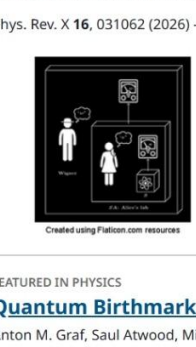
An asymmetric platinum interface enables noncollinear spin-orbit filtering, breaking bulk symmetry constraints to generate out-of-plane spin currents for field-free magnetization switching.

FEATURED IN PHYSICS
Topological Flowscape Reveals State Transitions in Nonreciprocal Living Matter
Hyunseok Lee, EliseAnne Koskelo, Shreyas Gokhale, Junang Li, Chenyi Fei, Chih-Wei Joshua Liu, Lisa Lin, Jörn Dunkel, Dominic J. Skinner, and Nikta Fakhri
Phys. Rev. X **16**, 031061 (2026) - Published 8 September, 2026



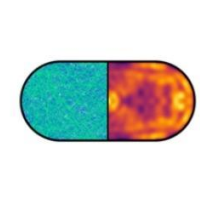
Characterizing living systems far from the thermodynamic limit can yield insight into the physics of nonreciprocity and biological self-organization.

General Quantum Circuit Framework for Extended Wigner's Friend Scenarios: Logically and Causally Consistent Reasoning without Absolute Measurement Events
V. Vilasini and Mischa P. Woods
Phys. Rev. X **16**, 031062 (2026) - Published 9 September, 2026



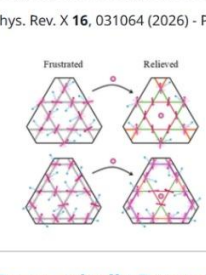
Researchers develop a quantum circuit framework for extended Wigner's friend scenarios, resolving logical paradoxes by tracking Heisenberg cuts.

FEATURED IN PHYSICS
Quantum Birthmarks: Ergodicity Breaking Beyond Scarring
Anton M. Graf, Saul Atwood, Mingxuan Xiao, Roland Ketzmerick, Eric J. Heller, and Joonas Keski-Rahkonen
Phys. Rev. X **16**, 031063 (2026) - Published 10 September, 2026



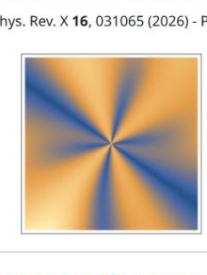
Researchers develop a theoretical framework showing that quantum systems permanently retain a memory of their initial state and early dynamics, in defiance of classical expectations.

Effective Ionic Valence and Local Magnetic Moment in Kagome Superconductors
Ruoshi Jiang, Zi-Jian Lang, Yuzki Oey, Andrea Capa Salinas, Stephen D. Wilson, Yongwei Li, Ilya Shipulin, Yiwen Zhang, Deng Hu, Zhiwei Wang, Hans-Henning Klauss, Zurab Guguchia, Vadim Grinenko, and Wei Ku
Phys. Rev. X **16**, 031064 (2026) - Published 10 September, 2026



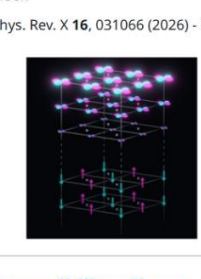
Revealing concealed ionic local moments in kagome superconductors reflects strong local correlations.

Geometrically Frustrated Quadrupoles on the Pyrochlore Lattice and Generalized Spin Liquids
Kristian Tyn Kai Chung, Sylvain Petit, Julien Robert, and Paul McClarty
Phys. Rev. X **16**, 031065 (2026) - Published 11 September, 2026



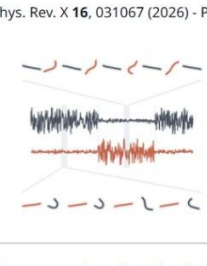
A semiclassical framework models quantum quadrupoles as biaxial tensors, showing how angular-momentum-dependent geometries dictate generalized nematic phases and quadrupolar spin liquids in frustrated magnets.

Emergent Altermagnetism at Surfaces of Antiferromagnets: Full Symmetry Classification and Material Identification
Colin Lange, Rodrigo Jaeschke-Ubiergo, Atasi Chakraborty, Xanthe H. Verbeek, Libor Šmejkal, Jairo Sinova, and Alexander Mook
Phys. Rev. X **16**, 031066 (2026) - Published 11 September, 2026



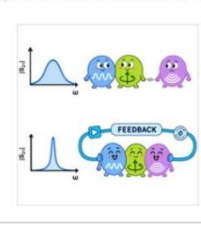
A theoretical surface spin-group framework demonstrates that surface symmetry breaking in conventional antiferromagnets naturally induces two-dimensional altermagnetism across more than 150 candidate materials.

Reversibility, Chaos, and Attractors in Periodically Sheared Elastic Filaments
Francesco Bonacci, Brato Chakrabarti, Olivia du Roure, Anke Lindner, and David Saintillan
Phys. Rev. X **16**, 031067 (2026) - Published 14 September, 2026



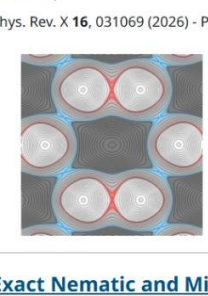
Combining experiments on actin filaments with numerical simulations, a previously unknown transition from reversible motion to intermittent, noise-driven chaos in single semiflexible filaments under periodic shear is unveiled.

Overcoming Intrinsic Material Limitations through Cavity Feedback
M. Ebrahimi, Y. Huang, V. A. S. V. Bittencourt, A. Rashedi, A. Metelmann, and J. P. Davis
Phys. Rev. X **16**, 031068 (2026) - Published 14 September, 2026



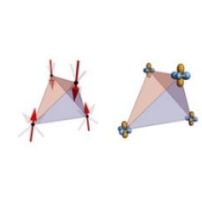
Active dissipation control via a feedback loop overcomes intrinsic magnetic losses, achieving strong coupling among photons, magnons, and phonons in cavity magnomechanics.

Pomeranchuk Instability Induced by an Emergent Higher-Order Van Hove Singularity on the Distorted Kagome Surface of
Pranab Kumar Nag, Rajib Batabyal, Julian Ingham, Noam Morali, Hengxin Tan, Jahyun Koo, Jean Souza, Moshe Haim, Armando Consiglio, Enke Liu, Raquel Queiroz, Ronny Thomale, Binghai Yan, Claudia Felser, Nurit Avraham, and Haim Beidenkopf
Phys. Rev. X **16**, 031069 (2026) - Published 15 September, 2026



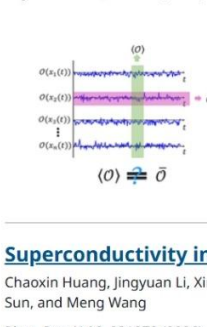
Surface deformation of the kagome lattice in flattens saddle points into a higher-order Van Hove singularity, triggering a -wave Pomeranchuk instability and nematic states.

Exact Nematic and Mixed Magnetic Phases Driven by Competing Orders on the Pyrochlore Lattice
Niccolò Francini, Lukas Schmidt, Lukas Janssen, and Daniel Lozano-Gómez
Phys. Rev. X **16**, 031070 (2026) - Published 16 September, 2026



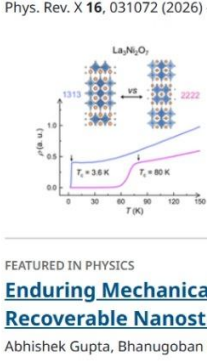
Analysis of a frustrated pyrochlore spin model demonstrates that thermal fluctuations and parameter-dependent symmetries suppress conventional order to stabilize a magnetic nematic phase.

Genuine and Spurious (Non-)Ergodicity in Single Particle Tracking
Wei Wang, Qing Wei, Igor M. Sokolov, Ralf Metzler, and Aleksei Chechkin
Phys. Rev. X **16**, 031071 (2026) - Published 17 September, 2026



The mean-squared increment is introduced as a new statistic to characterize single-particle positional time series data, providing a more precise and unambiguous method than previous approaches to evaluating ergodicity and helping to discriminate between different classes of stochastic processes.

Superconductivity in Monolayer-Trilayer Phase of under High Pressure
Chaoxin Huang, Jingyuan Li, Xing Huang, Hengyuan Zhang, Deyuan Hu, Mengwu Huo, Xiang Chen, Zhen Chen, Hualei Sun, and Meng Wang
Phys. Rev. X **16**, 031072 (2026) - Published 17 September, 2026

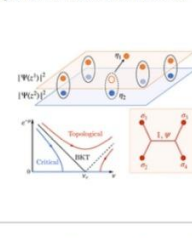


High-pressure studies on the 1313 monolayer-trilayer polymorph of reveal a dramatically reduced of , proving that coupled bilayer motifs are essential for superconductivity.

FEATURED IN PHYSICS
Enduring Mechanical Memory from the Constitutive Response of Elastically Recoverable Nanostructured Materials
Abhishek Gupta, Bhanugoban Maheswaran, Nicholas Jaegersberg, Komal Chawla, and Ramathasan Thevamaran
Phys. Rev. X **16**, 031073 (2026) - Published 18 September, 2026

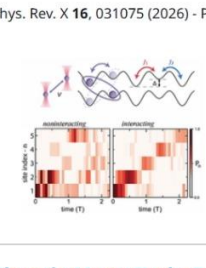
Vertically aligned carbon nanotube foams exhibit return point memory, opening new opportunities for mechanical computing applications.

Fractional Quantum Hall States under Density Decoherence
Zijian Wang, Ruihua Fan, Tianle Wang, Samuel J. Garratt, and Ehud Altman
Phys. Rev. X **16**, 031074 (2026) - Published 21 September, 2026



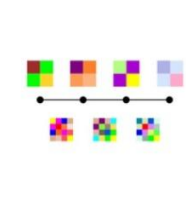
Statistical mechanics mappings reveal that quantum information stored in the non-Abelian anyons of Moore-Read states resists arbitrary density dephasing, whereas that stored in the Laughlin states has an infinite robustness only above a critical filling factor.

Interaction-Assisted Topological Pumping in Few- and Many-Atom Rydberg Arrays
Chenxi Huang, Tao Chen, Qian Liang, Matthew A. Krebs, Ethan Springhorn, Ruiyu Li, Mingsheng Tian, Kaden R. A. Hazzard, Jacob P. Covey, and Bryce Gadway
Phys. Rev. X **16**, 031075 (2026) - Published 21 September, 2026



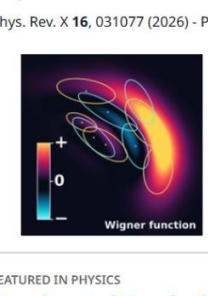
Strong dipolar interactions in Rydberg atom arrays are found to be able to bind particles into correlated pairs and clusters that undergo efficient topological pumping along a synthetic dimension.

Chaotic Many-Body Quantum Dynamics, Spectral Correlations, and Energy Diffusion
J. T. Chalker and Dominik Hahn
Phys. Rev. X **16**, 031076 (2026) - Published 23 September, 2026



Researchers analyze a solvable many-body model to demonstrate how energy diffusion governs spectral correlations in chaotic quantum systems.

Variational Multi-Gaussian Phase-Space Bosonic Dynamics via Automatic Differentiation
Jacopo Tosca, Francesco Carnazza, Luca Giacomelli, and Cristiano Ciuti
Phys. Rev. X **16**, 031077 (2026) - Published 24 September, 2026



Researchers introduce a variational multi-Gaussian phase-space method combining analytical techniques with automatic differentiation to reveal the critical dynamics of large open quantum bosonic lattices.

FEATURED IN PHYSICS
Quasicrystal Topological Hydrodynamics
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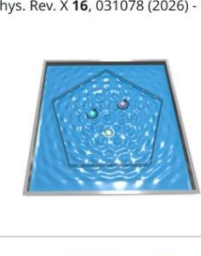
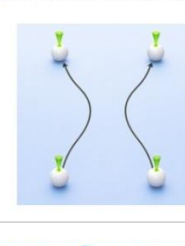


Quasicrystalline water waves allow exquisite insight into topological physics and provides a unique platform for manipulating particle for a wide range of applications.

Energy-Efficient Control of Interacting Microscopic Systems: When Longer Paths Save Energy
Samuel Monter, Lars T. Stutzer, Sarah A. M. Loos, and Clemens Bechinger
Phys. Rev. X **16**, 031079 (2026) - Published 30 September, 2026



Harnessing hydrodynamic interactions offers a route to control multiparticle systems efficiently, enabling substantial reductions in the energetic cost of microscopic transport.

Erratum: Programmable Quantum Anomalous Hall Insulator in Twisted Crystalline Flatbands [Phys. Rev. X 16, 011015 (2026)]
Wenxuan Wang, Yijie Wang, Zaizhe Zhang, Zihao Huo, Gengdong Zhou, Shu Zhang, Kenji Watanabe, Takashi Taniguchi, Xiaoxia Yang, Qing Dai, X. C. Xie, Kaihui Liu, Zhida Song, and Xiaobo Lu
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