Volume 24, Issue 3 (partial)

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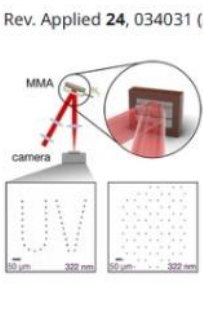
HIGHLIGHTED ARTICLES

FEATURED IN PHYSICS EDITORS' SUGGESTION

Dynamical spatial light modulation in the ultraviolet spectral range

Maximilian Ammenwerth, Hendrik Timme, Veronica Giardini, Renhao Tao, Flavien Gyger, Ohad Lib, Dirk Berndt, Dimitrios Kourkoulos, Tim Rom, Immanuel Bloch, and Johannes Zeiher

Phys. Rev. Applied **24**, 034031 (2025) - Published 11 September, 2025



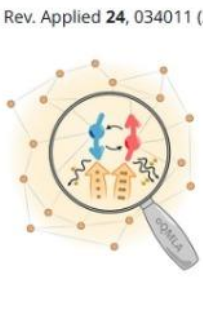
Spatial light modulation is vital for precision control in optics applications such as quantum computing, quantum simulation, and quantum metrology, but at ultraviolet wavelengths it has been hampered by device degradation and limited switching speed. This work overcomes those bottlenecks by employing a reflection-based piston-micromirror array to shape UV light fields, correct aberrations, and switch patterns in sync with laser pulses at 1 kHz, without adding detectable phase noise. The method yields *e.g.* optical tweezers with subpercent intensity variation, and exceptionally uniform flat-top beams, opening up the UV spectral range for applications based on arbitrary light shaping.

EDITORS' SUGGESTION

Learning-agent-based approach to the characterization of open quantum systems

Lorenzo Fioroni, Ivan Rojkov, and Florentin Reiter

Phys. Rev. Applied **24**, 034011 (2025) - Published 4 September, 2025



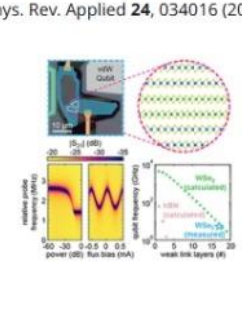
Now open for business: Characterizing open quantum systems is essential for advancing quantum technologies, where noise from the environment continues to limit performance. Progress in addressing this important issue has been hindered by the lack of scalable techniques to learn both coherent and dissipative dynamics from data. This study extends the Quantum Model Learning Agent framework to open systems, using the Lindblad master equation. By combining Bayesian inference with a genetic algorithm, the method enables automated, hardware-informed identification of noise processes. The results enable more precise calibration and control in real-world hardware implementations.

EDITORS' SUGGESTION

Crystalline superconductor-semiconductor Josephson junctions for compact superconducting qubits

Jesse Balgley, Jinho Park, Xuanjing Chu, Ethan G. Arnault, Martin V. Gustafsson, Leonardo Ranzani, Madisen Holbrook, Yangchen He, Kenji Watanabe, Takashi Taniguchi, Daniel Rhodes, Vasili Perebeinos, James Hone, and Kin Chung Fong

Phys. Rev. Applied **24**, 034016 (2025) - Published 5 September, 2025



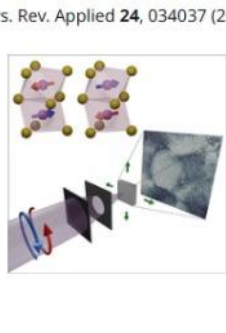
High-quality, single-crystal van der Waals (vdW) materials provide a promising platform for constructing Josephson junctions, but systematic studies have been limited by fabrication and measurement challenges. Here researchers characterize 24 vertical vdW superconductor-semiconductor junctions, including microwave spectroscopy of an all-vdW transmon qubit. Transport measurements reveal a crossover from proximity- to tunneling-type behavior with increasing semiconductor thickness. The results demonstrate how band alignment and materials engineering can be used to tailor qubit properties, establishing vdW heterostructures as an emerging platform for next-generation superconducting qubits.

EDITORS' SUGGESTION

Altermagnetic nanotextures revealed in bulk

Rikako Yamamoto, Luke Alexander Turnbull, Marcus Schmidt, José Claudio Corsaletti Filho, Hayden Jeffrey Binger, Marisel Di Pietro Martínez, Markus Weigand, Simone Finizio, Yurii Prots, George Matthew Ferguson, Uri Vool, Sebastian Wintz, and Claire Donnelly

Phys. Rev. Applied **24**, 034037 (2025) - Published 16 September, 2025



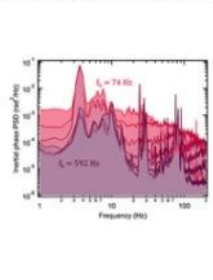
Altermagnets (collinear antiferromagnets that exhibit some of the properties of ferromagnets) hold promise for future technologies. Despite many theoretical predictions, however, confirming candidate materials remains challenging, and most experimental studies have been limited to thin films or surfaces. Here the authors use nanoscale transmission x-ray dichroic imaging to confirm the *bulk* altermagnetic nature of one of the most promising candidates, MnTe, in the absence of surface and strain effects. Nanoscale topological textures are observed to occur spontaneously in MnTe. This promising approach offers a route to explore other candidate altermagnets, going forward.

EDITORS' SUGGESTION

Noise resilience in a high-bandwidth atom interferometer

Jonathan M. Kwolek, Sunil Upadhyay, and Adam T. Black

Phys. Rev. Applied **24**, 034041 (2025) - Published 17 September, 2025



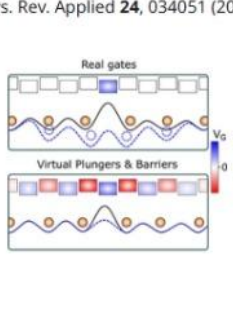
Inertial sensing underpins many navigation techniques, providing location information between position fixes. Atom interferometry has long been a candidate for superior inertial sensors, enabling improvements in short-term sensitivity and long-term stability, but realizing this potential requires understanding and mitigation of error sources, particularly in dynamic environments. This study demonstrates suppression of dynamic phase errors via rapid reversal of the direction of inertial sensitivity, at a rate much faster than the measurement bandwidth of the interferometer. The resulting noise resilience should prove useful in field applications of matter-wave interferometers.

EDITORS' SUGGESTION

Mitigation of exchange crosstalk in dense quantum dot arrays

Daniel Jirovec, Pablo Cova Fariña, Stefano Reale, Stefan D. Oosterhout, Xin Zhang, Sander de Snoo, Amir Sammak, Giordano Scappucci, Menno Veldhorst, and Lieven M. K. Vandersypen

Phys. Rev. Applied **24**, 034051 (2025) - Published 19 September, 2025



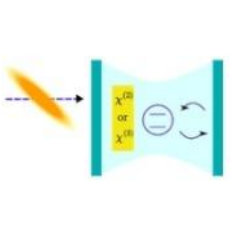
Spin qubits in gate-defined semiconductor quantum dots are a versatile platform for quantum computation and simulation, owing to their flexible operation and compatibility with CMOS foundry processes. Unfortunately, capacitive crosstalk—particularly via the exchange interaction between adjacent spins—is an ongoing issue. The authors study a 2×4 array of hole-spin qubits in Ge and find an easily tracked constant-exchange signature, to precisely quantify and compensate the crosstalk. They also note patterns tied to device geometry and fabrication processes. Their findings provide a method to benchmark exchange crosstalk, and suggest best practices for designing future large-scale devices.

EDITORS' SUGGESTION

Cavity quantum electrodynamics in a finite-bandwidth squeezed reservoir

Trung Kiên Lê, Daniil M. Lukin, Charles Roques-Carmes, Aviv Karnieli, Eran Lustig, Melissa A. Guidry, Shanhui Fan, and Jelena Vučković

Phys. Rev. Applied **24**, 034053 (2025) - Published 19 September, 2025



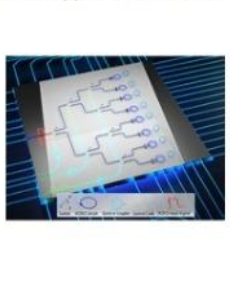
Light-matter interaction at the level of a single photon and atom is the core of quantum technologies for interfacing material qubits to "flying" qubits. Although loss remains a significant limitation in the optical domain, *quantum squeezing* may be used to enhance the light-matter interaction. This approach typically assumes a perfect bath with infinite bandwidth and no intrinsic cavity loss, which fails to capture realistic experimental conditions. In this work the authors develop a model that explains when squeezing may or may not assist in improving light-matter interaction, and they outline possible experimental platforms to attain squeezing-enhanced coupling.

EDITORS' SUGGESTION

On-chip direct-current source for scalable superconducting quantum computing

Lei Jiang *et al.*

Phys. Rev. Applied **24**, 034057 (2025) - Published 22 September, 2025



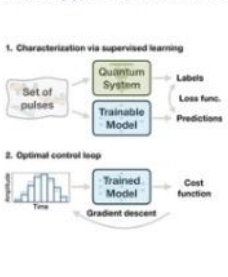
Applying magnetic flux to manipulate qubits is an important method in superconducting quantum computing, but the state-of-the-art approach based on room-temperature electronics suffers from some unscalable limitations. This work provides an alternative approach in which an rf SQUID serves as an *on-chip* source of direct current, to provide qubits with *in situ*, low-noise magnetic flux. Several single-pulse inputs are enough to modulate the source and provide qubits with flux; this can benefit from time-division multiplexing to save on cables and sources. The technique could provide a scalable solution for applying magnetic flux in fault-tolerant quantum computing.

EDITORS' SUGGESTION

Quantum optimal control of superconducting qubits based on machine-learning characterization

Élie Genois, Noah J. Stevenson, Noah Goss, Irfan Siddiqi, and Alexandre Blais

Phys. Rev. Applied **24**, 034073 (2025) - Published 26 September, 2025



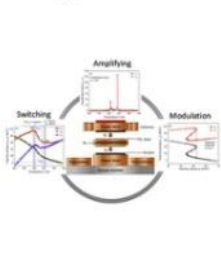
Open-loop quantum optimal control is a powerful technique to realize fast, high-fidelity quantum operations. Its successful implementation in real-world scenarios is limited, however, because it relies on a model of quantum dynamics that cannot attain the desired precision. This study uses physics-inspired machine learning to solve the problem, by inferring an accurate model of the dynamics from experimental data. The approach provides both a useful characterization of the system's behavior and the optimal controls to realize arbitrary operations on it, and thus is a valuable tool for quantum information processing.

EDITORS' SUGGESTION LETTER

Vanadium dioxide radiative thermal transistor achieves hundredfold amplification of far-field heat current

I. Alonzo-Zapata, C. Champeaux, F. Enguehard, J. Ordonez-Miranda, and F. Dumas-Bouchiat

Phys. Rev. Applied **24**, L031001 (2025) - Published 3 September, 2025



Phase-change materials such as VO offer exciting possibilities for thermal information processing and energy conversion, thanks to their tunable thermal properties that enable control of far-field radiative heat flow. This study presents a VO-based radiative thermal transistor that yields 100× amplification of far-field heat current. Along the way, the authors uncover how the phase-transition behavior, shaped by VO's microstructure and intrinsic properties, directly influences radiative heat transfer. This work could enable the development of thermal logic circuits, smarter heat management, and innovative thermal devices with enhanced performance.

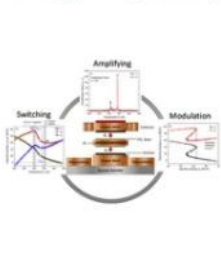
LETTERS

EDITORS' SUGGESTION LETTER

Vanadium dioxide radiative thermal transistor achieves hundredfold amplification of far-field heat current

I. Alonzo-Zapata, C. Champeaux, F. Enguehard, J. Ordonez-Miranda, and F. Dumas-Bouchiat

Phys. Rev. Applied **24**, L031001 (2025) - Published 3 September, 2025



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LETTER

Versatile reservoir computing for heterogeneous complex networks

Yao Du, Huawei Fan, and Xingang Wang

Phys. Rev. Applied **24**, L031002 (2025) - Published 10 September, 2025

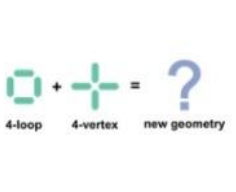
Can a small, versatile machine be trained on the time series of a few elements in a large, heterogeneous complex system, and then substitute any element while preserving its collective dynamics over a finite time horizon? Leveraging the technique of reservoir computing (RC) in machine learning, the authors demonstrate that such a machine can indeed be constructed, and performs effectively in general complex networks of heterogeneous dynamics and structure. The all-in-one, plug-and-play nature of versatile RC offers substantial convenience for maintaining the functionality of real-world complex systems that suffer sporadic or temporary component failures.

LETTER

Energy-relaxation pathways in finite-sized artificial square-ice structures

Hanu Arava, Noah Kern, Paula Mellado, Justin Woods, and Charudatta Phatak

Phys. Rev. Applied **24**, L031003 (2025) - Published 11 September, 2025



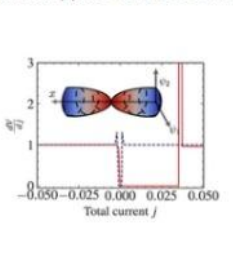
The authors show how specific geometric arrangement of finite-sized artificial square-ice structures directly governs their energy-relaxation pathways, and thus their probability of finding low-energy states. By systematically combining and modifying basic building blocks (4-loop and 4-vertex motifs), embedded and connected configurations can be designed to favor either monotonic (*quasi*-deterministic) or intermittent (probabilistic) relaxation. Dipolar energy calculations and magnetic force microscopy support the findings. This research provides a design principle for creating spin ices for future computing applications.

LETTER

Dissipation-enhanced nonreciprocal superconductivity: Application to multivalley superconductors

Sayan Banerjee and Mathias S. Scheurer

Phys. Rev. Applied **24**, L031004 (2025) - Published 15 September, 2025



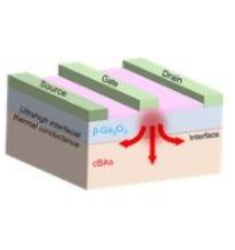
The *superconducting diode effect*, characterized by asymmetrical critical currents in opposite directions, is interesting in terms of both fundamental physics and potential for quantum electronics. This Letter offers a mechanism for the effect, based on a nonequilibrium theoretical framework that goes beyond conventional approaches. This approach allows the authors to incorporate the coupling between dissipative currents and time-reversal-symmetry-breaking order parameters, which can stabilize very strong nonreciprocity. While the mechanism is specifically illustrated for systems with two valleys, such as multilayer graphene, it remains more generally applicable.

LETTER

Ultrahigh interfacial thermal conductance for cooling gallium oxide electronics using cubic boron arsenide

Wenjiang Zhou, Nianjie Liang, Wei Xiao, Zhaofei Tong, Fei Tian, and Bai Song

Phys. Rev. Applied **24**, L031005 (2025) - Published 29 September, 2025



While gallium oxide offers major potential for power electronics, its poor thermal conductivity makes heat dissipation challenging. This study presents a cooling strategy centered on the heterogeneous integration of gallium oxide devices with cubic boron arsenide (-BAs). Using molecular dynamics simulations with machine-learned interatomic potentials, the authors find remarkable interfacial thermal conductance; this plus the ultrahigh thermal conductivity of -BAs yields notable reduction in device temperature. This work highlights -BAs as an outstanding material for cooling tomorrow's chips, and may facilitate the engineering of interfacial thermal transport at the atomic scale.

ARTICLES

Experimental investigation of the flow rate–pressure drop relation of a viscoelastic Boger fluid in a deformable channel

SungGyu Chun, Ivan C. Christov, and Jie Feng

Phys. Rev. Applied **24**, 034001 (2025) - Published 2 September, 2025

Disentangling the impact of quasiparticles and two-level systems on the statistics of superconducting-qubit lifetime

Shaojiang Zhu, Xinyuan You, Ugur Alyanak, Mustafa Bal, Francesco Crisa, Sabrina Garattoni, Andrei Lunin, Roman Pilipenko, Akshay Murthy, Alexander Romanenko, and Anna Grassellino

Phys. Rev. Applied **24**, 034002 (2025) - Published 2 September, 2025

Characterization and optimization of tunable couplers via adiabatic control in superconducting circuits

Xuan Zhang, Xu Zhang, Changling Chen, Kai Tang, Kangyuan Yi, Kai Luo, Zheshu Xie, Yuanzhen Chen, and Tongxing Yan

Phys. Rev. Applied **24**, 034003 (2025) - Published 2 September, 2025

Emulating time refraction at photonic time interfaces via smooth temporal transitions

Mariya Antyufeyeva and Victor Pacheco-Peña

Phys. Rev. Applied **24**, 034004 (2025) - Published 2 September, 2025

Monolithic 4*H*- nanomechanical resonators with high intrinsic quality factors

A. Hochreiter, P. Bredol, F. David, B. Demiralp, H.B. Weber, and E.M. Weig

Phys. Rev. Applied **24**, 034005 (2025) - Published 3 September, 2025

Directional driving of superconducting vortex lines with an oscillating magnetic field

A.E. Koshelev

Phys. Rev. Applied **24**, 034006 (2025) - Published 3 September, 2025

Optimizing two-qubit gates for ultracold atoms using Fermi-Hubbard models

Juhi Singh, Jan A.P. Reuter, Tommaso Calarco, Felix Motzoi, and Robert Zeier

Phys. Rev. Applied **24**, 034007 (2025) - Published 3 September, 2025

Effect of spin-dependent tunneling in a van der Waals heterostructure on exciton and trion emission

Annika Bergmann-Iwe, Swarup Deb, Klaus Zollner, Veronika Schneidt, Mustafa Hemaid, Kenji Watanabe, Takashi Taniguchi, Rico Schwartz, Jaroslav Fabian, and Tobias Korn

Phys. Rev. Applied **24**, 034008 (2025) - Published 3 September, 2025

Electric imaging and dynamics of the photocharged graphene edge

Zhe Ding, Zhousheng Chen, Xiaodong Fan, Weihui Zhang, Jun Fu, Yumeng Sun, Zhi Cheng, Zhiwei Yu, Kai Yang, Yuxin Li, Xing Liu, Pengfei Wang, Ya Wang, Jianhua Jiang, Hualing Zeng, Changgan Zeng, Guosheng Shi, Fazhan Shi, and Jiangfeng Du

Phys. Rev. Applied **24**, 034009 (2025) - Published 4 September, 2025

Transfer fields and Langevin forces for the noise analysis in diffusive nanodevices within the nonequilibrium Green's function approach

Francesco Bertazzi, Alberto Tibaldi, Jesus Alberto Gonzalez Montoya, Francesco Mercinelli, Michele Goano, Simona Donati Guerrieri, Fabrizio Bonani, and Giovanni Ghione

Phys. Rev. Applied **24**, 034010 (2025) - Published 4 September, 2025

EDITORS' SUGGESTION

Learning-agent-based approach to the characterization of open quantum systems

Lorenzo Fioroni, Ivan Rojkov, and Florentin Reiter

Phys. Rev. Applied **24**, 034011 (2025) - Published 4 September, 2025

Now open for business: Characterizing open quantum systems is essential for advancing quantum technologies, where noise from the environment continues to limit performance. Progress in addressing this important issue has been hindered by the lack of scalable techniques to learn both coherent and dissipative dynamics from data. This study extends the Quantum Model Learning Agent framework to open systems, using the Lindblad master equation. By combining Bayesian inference with a genetic algorithm, the method enables automated, hardware-informed identification of noise processes. The results enable more precise calibration and control in real-world hardware implementations.

Effective schemes for fusion of hyperentangled states

Wen-Xiu Zhang, Wen-Qiang Liu, and Hai-Rui Wei

Phys. Rev. Applied **24**, 034012 (2025) - Published 4 September, 2025

Ion counting and temperature determination of Coulomb-crystallized laser-cooled ions in traps using convolutional neural networks

Yanning Yin and Stefan Willitsch

Phys. Rev. Applied **24**, 034013 (2025) - Published 4 September, 2025

Nonvolatile multistate electrothermal resistive switching in a strongly correlated insulator thin-film device

Farnaz Tahouni-Bonab, Matthias Hepting, Theodor Luibrand, Georg Cristiani, Christoph Schmid, Gennady Logvenov, Bernhard Keimer, Reinhold Kleiner, Dieter Koelle, and Stefan Guénon

Phys. Rev. Applied **24**, 034014 (2025) - Published 5 September, 2025

Ferromagnetic traps for quasicontinuous operation of optical nanofiber interfaces

Ruijuan Liu, Jinggu Wu, Yuan Jiang, Yanting Zhao, and Saijun Wu

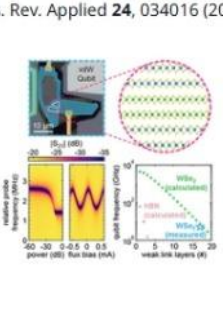
Phys. Rev. Applied **24**, 034015 (2025) - Published 5 September, 2025

EDITORS' SUGGESTION

Crystalline superconductor-semiconductor Josephson junctions for compact superconducting qubits

Jesse Balgley, Jinho Park, Xuanjing Chu, Ethan G. Arnault, Martin V. Gustafsson, Leonardo Ranzani, Madisen Holbrook, Yangchen He, Kenji Watanabe, Takashi Taniguchi, Daniel Rhodes, Vasili Perebeinos, James Hone, and Kin Chung Fong

Phys. Rev. Applied **24**, 034016 (2025) - Published 5 September, 2025



High-quality, single-crystal van der Waals (vdW) materials provide a promising platform for constructing Josephson junctions, but systematic studies have been limited by fabrication and measurement challenges. Here researchers characterize 24 vertical vdW superconductor-semiconductor junctions, including microwave spectroscopy of an all-vdW transmon qubit. Transport measurements reveal a crossover from proximity- to tunneling-type behavior with increasing semiconductor thickness. The results demonstrate how band alignment and materials engineering can be used to tailor qubit properties, establishing vdW heterostructures as an emerging platform for next-generation superconducting qubits.

Chalcogenide halide (= ; =) monolayers as gate dielectrics for two-dimensional field-effect transistors

Huan Liu, Lixiang Rao, Junjie Qi, and Gang Tang

Phys. Rev. Applied **24**, 034017 (2025) - Published 5 September, 2025

Accurate unsupervised photon counting from transition-edge-sensor signals

Nicolas Dalbec-Constant, Guillaume Thekkadath, Duncan England, Benjamin Sussman, Thomas Gerrits, and Nicolás Quesada

Phys. Rev. Applied **24**, 034018 (2025) - Published 5 September, 2025

Acoustic angular sorting of resonant subwavelength particles

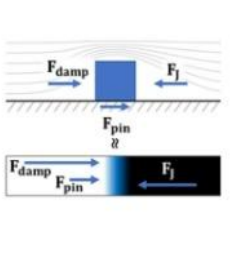
Ivan Toftul, Yuri S. Kivshar, and Mikhail Lapine

Phys. Rev. Applied **24**, 034019 (2025) - Published 8 September, 2025

Kinematic model of magnetic-domain-wall motion for fast, high-accuracy simulations

Alexander J. Edwards, Kristi Doleh, Leonard Humphrey, Chandler M. Linseisen, Michael D. Kitcher, Joanna M. Martin, Can Cui, Jean Anne C. Incorvia, Felipe Garcia-Sanchez, Naimul Hassan, and Joseph S. Friedman

Phys. Rev. Applied **24**, 034020 (2025) - Published 8 September, 2025



Domain-wall (DW) devices have garnered interest for diverse applications including memory, logic, and neuromorphic primitives; thus fast, accurate device models are imperative. Existing models of DW motion are suboptimal for large systems: They either devour computational resources, or oversimplify the physics. The authors propose a DW model inspired by the phenomenological similarities between the motion of a DW and that of a classical object subject to forces like friction or drag. This model predicts essentially the same DW motion as do micromagnetic simulations, but 4000× as fast. It is also faster than collective-coordinate models, and much more accurate than hyper-reduced models.

Interlayer coupling and exciton dynamics in two-dimensional hybrid structures based on an quantum well coupled to a monolayer

D. Chen, D. Lagarde, L. Hemmen, L. Lombez, P. Renucci, M. Mauguet, L. Ren, C. Robert, N. Grandjean, and X. Marie

Phys. Rev. Applied **24**, 034021 (2025) - Published 8 September, 2025

Continuous-time ultrahigh-frequency sensing using cold Rydberg atoms

Matt J. Jamieson, C. Stuart Adams, Kevin J. Weatherill, Ryan K. Hanley, Natalia Alves, and James Keaveney

Phys. Rev. Applied **24**, 034022 (2025) - Published 8 September, 2025

Smectic bubble lasers for acoustic and pressure measurements in air and water

Zala Korenjak and Matjaž Humar

Phys. Rev. Applied **24**, 034023 (2025) - Published 8 September, 2025

Derivation of the generalized heat transport equation and comparison with existing models

Upendra Yadav, Chaduvula Nikhil Sai Goutham, Ketan Meshram, Abhishek Pathak, Dipanshu Bansal, and Amit Agrawal

Phys. Rev. Applied **24**, 034024 (2025) - Published 9 September, 2025

Error-resilient geometric entangling gates in Rydberg atoms

Yan Liang, Xue-Dong Tian, Li-Na Ji, and Zheng-Yuan Xue

Phys. Rev. Applied **24**, 034025 (2025) - Published 9 September, 2025

Robustness of longitudinal transmon readout to ionization

Alex A. Chapple, Alexander McDonald, Manuel H. Muñoz-Arias, Mathieu Lachapelle, and Alexandre Blais

Phys. Rev. Applied **24**, 034026 (2025) - Published 9 September, 2025

High-order-modulation large MIMO detector based on physics-inspired methods

Qing-Guo Zeng, Xiao-Peng Cui, Xian-Zhe Tao, Jia-Qi Hu, Shi-Jie Pan, Wei E.I. Sha, and Man-Hong Yung

Phys. Rev. Applied **24**, 034027 (2025) - Published 10 September, 2025

Rattling-driven low thermal conductivity in () and anomalous optical phonon dominance in

Yufeng Liang, Yinchang Zhao, Xichang Wang, Jun Ni, and Zhenhong Dai

Phys. Rev. Applied **24**, 034028 (2025) - Published 10 September, 2025

Large spin-shuttling oscillations enabling high-fidelity single-qubit gates

Akshay Menon Pazhedath, Alessandro David, Max Oberländer, Matthias M. Müller, Tommaso Calarco, Hendrik Bluhm, and Felix Motzoi

Phys. Rev. Applied **24**, 034029 (2025) - Published 11 September, 2025

Generalized Brewster effect at exceptional points via cascaded non-Hermitian metasurfaces

Shixian Hu, Yuxuan Liu, Yadong Xu, and Jie Luo

Phys. Rev. Applied **24**, 034030 (2025) - Published 11 September, 2025

FEATURED IN PHYSICS EDITORS' SUGGESTION

Dynamical spatial light modulation in the ultraviolet spectral range

Maximilian Ammenwerth, Hendrik Timme, Veronica Giardini, Renhao Tao, Flavien Gyger, Ohad Lib, Dirk Berndt, Dimitrios Kourkoulos, Tim Rom, Immanuel Bloch, and Johannes Zeiher

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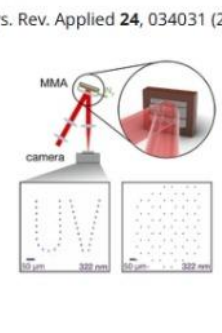

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Effect of top metallic contacts on energy conversion performances for near-field thermophotovoltaics

Youssef Jeyar, Kevin Austry, Minggang Luo, Brahim Guizal, Yi Zheng, Riccardo Messina, Rodolphe Vaillon, and Mauro Antezza

Phys. Rev. Applied **24**, 034032 (2025) - Published 12 September, 2025

Optical cavity in the relativistic regime for laser propulsion

F. Lorenzi, L. Salasnich, and M.G. Pelizzo

Phys. Rev. Applied **24**, 034033 (2025) - Published 12 September, 2025

Enabling a Potts machine with phase tristability

Ahmed A. Mekawy, Hady Moussa, Geng Xu, Mohammad-Ali Miri, and Andrea Alù

Phys. Rev. Applied **24**, 034034 (2025) - Published 12 September, 2025

Quantifying stress states of theoretically modeled polarimetric measurements on dielectric media

Felix B. Müller and Georgios Ctistis

Phys. Rev. Applied **24**, 034035 (2025) - Published 15 September, 2025

Scanning magnetic imaging of geological samples based on fiber-coupled diamond quantum magnetometry

Yu-An Du, Qianwen Ying, Cuihong Li, Shao-Chun Zhang, Fang-Wen Sun, Aimin Du, Huafeng Qin, and Yongxin Pan

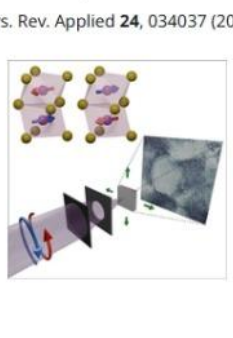
Phys. Rev. Applied **24**, 034036 (2025) - Published 15 September, 2025

EDITORS' SUGGESTION

Altermagnetic nanotextures revealed in bulk

Rikako Yamamoto, Luke Alexander Turnbull, Marcus Schmidt, José Claudio Corsaletti Filho, Hayden Jeffrey Binger, Marisel Di Pietro Martínez, Markus Weigand, Simone Finizio, Yurii Prots, George Matthew Ferguson, Uri Vool, Sebastian Wintz, and Claire Donnelly

Phys. Rev. Applied **24**, 034037 (2025) - Published 16 September, 2025



Altermagnets (collinear antiferromagnets that exhibit some of the properties of ferromagnets) hold promise for future technologies. Despite many theoretical predictions, however, confirming candidate materials remains challenging, and most experimental studies have been limited to thin films or surfaces. Here the authors use nanoscale transmission x-ray dichroic imaging to confirm the *bulk* altermagnetic nature of one of the most promising candidates, MnTe, in the absence of surface and strain effects. Nanoscale topological textures are observed to occur spontaneously in MnTe. This promising approach offers a route to explore other candidate altermagnets, going forward.

Inefficiency of orbital Hall effect on the spin torque in transition metal/ferromagnet bilayers

Yizhuo Song, Jialin Tian, Fanxing Zheng, Jianting Dong, Meng Zhu, and Jia Zhang

Phys. Rev. Applied **24**, 034038 (2025) - Published 16 September, 2025

Unraveling the flow of information in a nonequilibrium process in the presence of hydrodynamic interactions

Biswajit Das, Sreekanth K. Manikandan, and Ayan Banerjee

Phys. Rev. Applied **24**, 034039 (2025) - Published 16 September, 2025

Observation and mitigation of microwave echoes from dielectric defects in Josephson traveling-wave amplifiers

Matteo Boselli, Joel Grebel, Ambroise Peugeot, Rémy Dassonneville, Benjamin Huard, and Audrey Bienfait

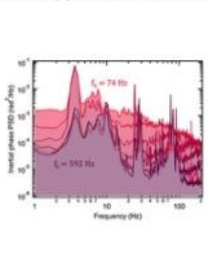
Phys. Rev. Applied **24**, 034040 (2025) - Published 17 September, 2025

EDITORS' SUGGESTION

Noise resilience in a high-bandwidth atom interferometer

Jonathan M. Kwolek, Sunil Upadhyay, and Adam T. Black

Phys. Rev. Applied **24**, 034041 (2025) - Published 17 September, 2025



Inertial sensing underpins many navigation techniques, providing location information between position fixes. Atom interferometry has long been a candidate for superior inertial sensors, enabling improvements in short-term sensitivity and long-term stability, but realizing this potential requires understanding and mitigation of error sources, particularly in dynamic environments. This study demonstrates suppression of dynamic phase errors via rapid reversal of the direction of inertial sensitivity, at a rate much faster than the measurement bandwidth of the interferometer. The resulting noise resilience should prove useful in field applications of matter-wave interferometers.

Quantum sensing enhanced via periodic modulation

Jia-Xin Peng and Muhammad Asjad

Phys. Rev. Applied **24**, 034042 (2025) - Published 17 September, 2025

Acoustic leaky-wave antennas from zero-index metamaterials

Keqiang Lyu, Mohamed Farhat, and Ying Wu

Phys. Rev. Applied **24**, 034043 (2025) - Published 17 September, 2025

Transmon-assisted high-fidelity controlled- gates for integer fluxonium qubits

J.-H. Wang, H. Xiong, J.-Z. Yang, H.-Y. Zhang, Y.-P. Song, and L.-M. Duan

Phys. Rev. Applied **24**, 034044 (2025) - Published 17 September, 2025

Tuning magneto-optical zero reflection via dual-channel hybrid magnonics

Andrew Christy, Yujie Zhu, Yi Li, Yuzan Xiong, Tao Qu, Frank Tsui, James F. Cahoon, Binbin Yang, Jia-Mian Hu, and Wei Zhang

Phys. Rev. Applied **24**, 034045 (2025) - Published 18 September, 2025

Deterministic switching of perpendicular magnetization using Néel-order-engineered out-of-plane spin in a single ferromagnet

Baiqing Jiang, Ziqian Cui, Hanying Zhang, Yuan Wang, and C. Bi

Phys. Rev. Applied **24**, 034046 (2025) - Published 18 September, 2025

Spin-flip two-level-system-induced anomalous magnetic field properties in thin-film superconducting resonators

Zi-Qing Huang, Shu-Kun Ye, Yong-Qiang Xu, Tian-Yi Jiang, Tian-Yue Hao, Bao-Chuan Wang, Xiang-Xiang Song, Hai-Ou Li, Guang-Can Guo, Gang Cao, and Guo-Ping Guo

Phys. Rev. Applied **24**, 034047 (2025) - Published 18 September, 2025

Timing discrimination of multiple photoelectron signals based on a convolutional neural network

Hailong Guo, Ahai Chen, Xinglong Yu, Ruichao Dong, Zhixian Wu, Jie Liu, Tianmin Yan, Zhenjie Shen, Xincheng Wang, and Yuhai Jiang

Phys. Rev. Applied **24**, 034048 (2025) - Published 18 September, 2025

Locomotion of a scallop-inspired swimmer in granular matter

Hongyi Xiao, Harol Torres, Achim Sack, and Thorsten Pöschel

Phys. Rev. Applied **24**, 034049 (2025) - Published 18 September, 2025

Efficient charge-to-spin conversion in the topological superconductor β- at room temperature

Yu-Seng Ku, Chih-Chieh Chiang, Shuan-Cheng Mai, Jing-Yo Chen, Chao-Wei Chen, Yi-Ying Chin, Yann-Wen Lan, Danru Qu, C.L. Chien, and Ssu-Yen Huang

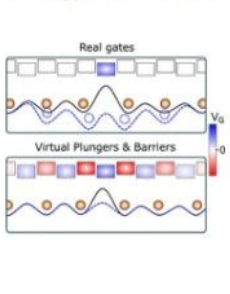
Phys. Rev. Applied **24**, 034050 (2025) - Published 19 September, 2025

EDITORS' SUGGESTION

Mitigation of exchange crosstalk in dense quantum dot arrays

Daniel Jirovec, Pablo Cova Fariña, Stefano Reale, Stefan D. Oosterhout, Xin Zhang, Sander de Snoo, Amir Sammak, Giordano Scappucci, Menno Veldhorst, and Lieven M. K. Vandersypen

Phys. Rev. Applied **24**, 034051 (2025) - Published 19 September, 2025



Spin qubits in gate-defined semiconductor quantum dots are a versatile platform for quantum computation and simulation, owing to their flexible operation and compatibility with CMOS foundry processes. Unfortunately, capacitive crosstalk—particularly via the exchange interaction between adjacent spins—is an ongoing issue. The authors study a 2×4 array of hole-spin qubits in Ge and find an easily tracked constant-exchange signature, to precisely quantify and compensate the crosstalk. They also note patterns tied to device geometry and fabrication processes. Their findings provide a method to benchmark exchange crosstalk, and suggest best practices for designing future large-scale devices.

Giant temperature-independent ultraviolet circular dichroism in () Heusler magnetic thin films

Yao Zhang, Jie Sung, Yuefeng Yin, Yu-Ying Chang, Nikhil V. Medhekar, Simon Granville, and Hua-Shu Hsu

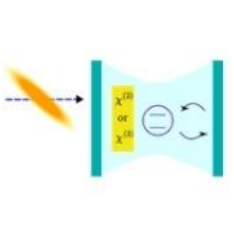
Phys. Rev. Applied **24**, 034052 (2025) - Published 19 September, 2025

EDITORS' SUGGESTION

Cavity quantum electrodynamics in a finite-bandwidth squeezed reservoir

Trung Kiên Lê, Daniil M. Lukin, Charles Roques-Carmes, Aviv Karnieli, Eran Lustig, Melissa A. Guidry, Shanhui Fan, and Jelena Vučković

Phys. Rev. Applied **24**, 034053 (2025) - Published 19 September, 2025



Light-matter interaction at the level of a single photon and atom is the core of quantum technologies for interfacing material qubits to "flying" qubits. Although loss remains a significant limitation in the optical domain, *quantum squeezing* may be used to enhance the light-matter interaction. This approach typically assumes a perfect bath with infinite bandwidth and no intrinsic cavity loss, which fails to capture realistic experimental conditions. In this work the authors develop a model that explains when squeezing may or may not assist in improving light-matter interaction, and they outline possible experimental platforms to attain squeezing-enhanced coupling.

Dynamical synthetic antiferromagnetic skyrmions and skyrmionia

Shun Wang, Linrong Yao, Yan Zhou, and Sheng Jiang

Phys. Rev. Applied **24**, 034054 (2025) - Published 19 September, 2025

Chiral locking of magnon flow and electron-spin accumulation in near-field radiative spin transfer

Xi-Han Zhou, Xiyin Ye, and Tao Yu

Phys. Rev. Applied **24**, 034055 (2025) - Published 22 September, 2025

Thermally controlled magneto-optical metasurface for tunable Faraday rotation

P.V. Zorina, D.O. Ignatyeva, S. Xia, P.E. Zimnyakova, L. Bi, and V.I. Belotelov

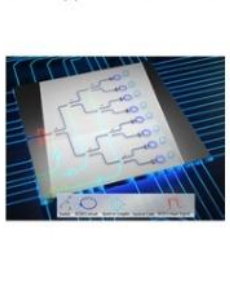
Phys. Rev. Applied **24**, 034056 (2025) - Published 22 September, 2025

EDITORS' SUGGESTION

On-chip direct-current source for scalable superconducting quantum computing

Lei Jiang *et al.*

Phys. Rev. Applied **24**, 034057 (2025) - Published 22 September, 2025



Applying magnetic flux to manipulate qubits is an important method in superconducting quantum computing, but the state-of-the-art approach based on room-temperature electronics suffers from some unscalable limitations. This work provides an alternative approach in which an rf SQUID serves as an *on-chip* source of direct current, to provide qubits with *in situ*, low-noise magnetic flux. Several single-pulse inputs are enough to modulate the source and provide qubits with flux; this can benefit from time-division multiplexing to save on cables and sources. The technique could provide a scalable solution for applying magnetic flux in fault-tolerant quantum computing.

Intersublattice-interaction-driven two-step ultrafast demagnetization in thin films of -- ferrimagnetic alloy

Runhua Zhang, Chengyu Yang, Jinshan Wang, Liping Tong, Mingli Ge, Yuan Li, Weidong Meng, Xiaowei Zhou, Zhu Liu, and Yang Ren

Phys. Rev. Applied **24**, 034058 (2025) - Published 22 September, 2025

Bianisotropic response of asymmetrical acoustic scatterers, including the quadrupole couplings

Gaokun Yu and Zijian Shi

Phys. Rev. Applied **24**, 034059 (2025) - Published 22 September, 2025

Radioplasmonic absorption in a biological tissue phantom

Nicholas J. Rommelfanger, Gil Marigold Malinao, Kenneth Brinson, Jr., Analiese M. Bancroft, and Guosong Hong

Phys. Rev. Applied **24**, 034060 (2025) - Published 23 September, 2025

Supersonic wave propagation in active non-Hermitian acoustic metamaterials

Kangkang Wang, Felix Langfeldt, Chen Shen, Haishan Zou, Sipei Zhao, Jing Lu, and Lea Sirota

Phys. Rev. Applied **24**, 034061 (2025) - Published 23 September, 2025

Quantum state preparation for probability distributions with reflection symmetry using matrix-product states

Yuichi Sano and Ikko Hamamura

Phys. Rev. Applied **24**, 034062 (2025) - Published 23 September, 2025

High magnetic sensitivity via large-diameter-vortex stability in magnetic tunnel junctions through controlled anisotropy

Benjamin J. Brown, Liam K. Mitchell, Vineetha S. Bheemarasetty, H. Minh Cao, Justin N. Kingsnorth, Jerome N. Sanes, and Gang Xiao

Phys. Rev. Applied **24**, 034063 (2025) - Published 23 September, 2025

Microwave-activated high-fidelity three-qubit gate scheme for fixed-frequency superconducting qubits

Kui Zhao, Wei-Guo Ma, Ziting Wang, Hao Li, Kaixuan Huang, Yun-Hao Shi, Kai Xu, and Heng Fan

Phys. Rev. Applied **24**, 034064 (2025) - Published 24 September, 2025

Depolarization and high permittivity in ferroelectric nanopillar capacitors caused by domain relaxation: A phase-field study

Huanhuan Tian, Jianguo Yang, and Ming Liu

Phys. Rev. Applied **24**, 034065 (2025) - Published 24 September, 2025

Degenerate zero-energy-line symmetric topological disclination modes in photonic crystals

Yuexin Zhang, Jie Tang, Lanxin Luo, Xiaoyu Dai, and Yuanjiang Xiang

Phys. Rev. Applied **24**, 034066 (2025) - Published 24 September, 2025

Probabilistic computing accelerated by spike-frequency adaptation: Applications in integer factorization

Haijie Xu, Cen Wang, Yajun Zhang, Yue Zhang, and Zhe Yuan

Phys. Rev. Applied **24**, 034067 (2025) - Published 24 September, 2025

Polarization-dynamics model of triaxial modulation in spin-exchange-relaxation-free atomic magnetometers

Ziao Liu, Jianli Li, Xiaoyu Li, Jianwei Sheng, Zhongyu Wang, Shushan Gao, and Jixi Lu

Phys. Rev. Applied **24**, 034068 (2025) - Published 25 September, 2025

Entanglement classification of arbitrary three-qubit states via artificial neural networks

Jorawar Singh, Vaishali Gulati, Kavita Dorai, and Arvind

Phys. Rev. Applied **24**, 034069 (2025) - Published 25 September, 2025

Gate-based initialization and fidelity in correlated open quantum systems

Sirui Chen, Jiahao Chen, and Dragomir Davidović

Phys. Rev. Applied **24**, 034070 (2025) - Published 25 September, 2025

Laser-noise-immune pulsed optically pumped atomic clock by means of differential detection

Xuejie Li, Yuhan Yan, Bowen Yang, Haojie Zhao, Jianliao Deng, Huadong Cheng, and L.Q. Chen

Phys. Rev. Applied **24**, 034071 (2025) - Published 25 September, 2025

Floquet-engineered fast SNAP gates in weakly coupled circuit-QED systems

Xinyuan You, Andy C.Y. Li, Tanay Roy, Shaojiang Zhu, Alexander Romanenko, Anna Grassellino, Yao Lu, and Srivatsan Chakram

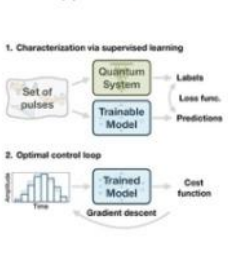
Phys. Rev. Applied **24**, 034072 (2025) - Published 25 September, 2025

EDITORS' SUGGESTION

Quantum optimal control of superconducting qubits based on machine-learning characterization

Élie Genois, Noah J. Stevenson, Noah Goss, Irfan Siddiqi, and Alexandre Blais

Phys. Rev. Applied **24**, 034073 (2025) - Published 26 September, 2025



Open-loop quantum optimal control is a powerful technique to realize fast, high-fidelity quantum operations. Its successful implementation in real-world scenarios is limited, however, because it relies on a model of quantum dynamics that cannot attain the desired precision. This study uses physics-inspired machine learning to solve the problem, by inferring an accurate model of the dynamics from experimental data. The approach provides both a useful characterization of the system's behavior and the optimal controls to realize arbitrary operations on it, and thus is a valuable tool for quantum information processing.

Energy-efficient generation of high-frequency spin waves in /Co-based heterostructures using laser pulses

Dimple Sneha Pamarthi, Elena Popova, Nirina Randrianantoandro, Gwenaëlle Vaudel, Pascal Ruello, Michel Hehn, Niels Keller, and Marwan Deb

Phys. Rev. Applied **24**, 034074 (2025) - Published 26 September, 2025

Experimental investigation of twist conservation in nonlinear optical three-wave mixing

G.H. dos Santos, A.L.S. Santos Junior, M. Gil de Oliveira, A.C. Barbosa, B. Pinheiro da Silva, N. Rubiano da Silva, G. Cañas, S.P. Walborn, A.Z. Khoury, and P.H. Souto Ribeiro

Phys. Rev. Applied **24**, 034075 (2025) - Published 26 September, 2025

Quantum-enhanced radio-frequency photonic distributed imaging

Haowei Shi, Christopher M. Jones, Mengjie Yu, Zheshen Zhang, and Quntao Zhuang

Phys. Rev. Applied **24**, 034076 (2025) - Published 26 September, 2025

Single-microphone speaker localization using acoustic metamaterial antenna and voiceprint recognition

Xin Li, Zeng-Xin Cai, Chu-Yao Feng, Xin-Ye Zou, Qian Chen, and Jian-Chun Cheng

Phys. Rev. Applied **24**, 034077 (2025) - Published 26 September, 2025

Protecting intercavity polaritons in strongly coupled cavities

Rodrigo Sánchez-Martínez, Yesenia A. García Jomaso, David Ley Domínguez, César L. Ordóñez-Romero, Hugo A. Lara-García, Giuseppe Pirruccio, and Arturo Camacho-Guardian

Phys. Rev. Applied **24**, 034078 (2025) - Published 29 September, 2025

Reconfigurable Boolean logic gates with a single spin-orbit-torque magnetic tunnel junction

Ran Zhang, Caihua Wan, Mingkun Zhao, Xiaohan Li, Yingqian Xu, Shiqiang Liu, Dehao Kong, Shilong Xiong, Guoqiang Yu, and Xiufeng Han

Phys. Rev. Applied **24**, 034079 (2025) - Published 29 September, 2025

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