Volume 25, Issue 5

May 2026

Browse Issues: Prev | Next

HIGHLIGHTED ARTICLES

Optical Metrology | Optical Properties of Materials

Alternative approach to time-delay interferometry with an optical frequency comb

Jan Pomarski, Jean-Pierre Ansot, Charlotte Bellehumeur, Antoine Jacquinot, and Joseph Gomes

Phys. Rev. Applied (RA) 25(5)L050201 - Published Friday, 2026

Laser and clock noise dominate the raw data streams of space-based gravitational-wave detectors, necessitating numerical post-processing to recover a stable signal. Optical frequency combs offer a unified solution by coherently linking these two noise sources. The proposed architecture uses a single frequency comb. The authors show that key noise characteristics—including offsets, drifts, and jitter—can be retrieved from the existing interferometer data streams. Simulations for a Michelson interferometer configuration demonstrate clock synchronization with an accuracy of 5 ns or better, along with a noise performance of 10 pm/√Hz.

Optical Coherence

Revealing negative thermal expansion and contracting dominant sub-correlation functions in water polycrystalline ice

Tai Tomo, Takuro Katayama, Kyoka Sugimoto, and Shinichiro Nakamura

Phys. Rev. Applied (RA) 25(5)L050202 - Published Friday, 2026

Spin correlations and their coupling to the lattice underpin magnetoelastic functionality, yet conventional probes capture only its collective response. By selectively evolving crystal field light or phonon modes, the authors show that the spin response decomposes into the generation of acoustic strain pulses. These distinct temporal dependences expose multiple spin-orientation channels, and unravel how magnetoelastic coupling shapes the ultrafast magnetoelastic response of Co/Ni. This approach lights an ultrafast acoustic tool for resolving magnetic contributions to mechanical response.

Optical Coherence

Synthesis of artificial transmission lines tailored for traveling-wave parametric processes

M. Malnou

Phys. Rev. Applied (RA) 25(5)L050203 - Published Friday, 2026

Traveling-wave parametric amplifiers (TWPAs), essential components of superconducting quantum processors, are built from artificial transmission lines. Conventional design approaches, based on Floquet theory, specify parametric processes, while supplying dynamical cross-talk is a efficient framework to guide the design of such dispersive resonators. This Letter shows that the dispersion relation of a periodic transmission line provides a complete and flexible synthesis. Alternative architectures are revealed, including an "embedded-mixer" light-field TWPA.

Optical Coherence

Diamond-based magnetometer aboard the International Space Station

Tania Resende, Alex Guerreiro, Betty Sensabaugh, Vikas Bendre, Sam Buchanan, Nicolas Sylvain, Hanna Kirchner, Jeffrey Bennett, Jonathan Hodowanec, Tomas Ramos, Jonathan Hanzelka, Tomas Vasquez, Jack Lindsey, Stephen Ellis, Ethan Rosenthal, and Jonathan Hirsch

Phys. Rev. Applied (RA) 25(5)L050204 - Published Friday, 2026

Precise mapping of the geomagnetic field is essential for geophysics, space weather, and navigation, but current magnetometers are limited by Earth-based noise and power constraints. This Letter presents the CASI-MS-DM quantum magnetometer based on nitrogen-vacancy centers in diamond, achieving sector magnetic field sensitivity of 1 nT/√Hz and a dynamic range of 1 mT, with power and sensitivity below 200 mW/1 Hz. They further validate its performance through direct comparison to geomagnetic field models, demonstrating accuracy within 1 nT and a root-mean-square error of 3 nT. This establishes diamond-based quantum magnetometry as viable for compact, high-performance space missions.

Optical Coherence

Enhanced cavity factors at resonance in acoustofluidic cavities embedded in nacelled elastic metamaterials

Valentin Freedman and Hendrik Bruus

Phys. Rev. Applied (RA) 25(5)L050205 - Published Friday, 2026

Microscale ultrasound acoustofluidics has become an important tool for handling cells and microparticles in lab-on-a-chip technology, but the underlying theory has been restricted to simple geometries. This Letter introduces a general theory for acoustofluidic cavities of arbitrary shape. It derives the cavity factor, the key dimensionless quantity that governs acoustic resonance, and shows that it can be enhanced by embedding the microfluidic cavity in a nacelled elastic metamaterial. Numerical simulations of the fluid and the metamaterial carry out the theoretical predictions and show that the cavity factor can be enhanced by more than a factor of 10 at resonance.

Optical Coherence

Perfectly matched metamaterials

Jorge Ruiz-Garcia and Andrew Alù

Phys. Rev. Applied (RA) 25(5)L050206 - Published Friday, 2026

Arbitrary control of electromagnetic waves is pivotal to the development of high-performance communications, sensing, and analog computing systems. Ion complex field transformations imply that such control can be achieved by engineering the constitutive tensors of their media. This work shows that metamaterials can be engineered to provide unprecedented field control over broad bandwidths and arbitrary polarization states. The key advantage of the proposed approach over earlier techniques, such as transformation optics, are discussed. These metamaterials provide a new paradigm for electromagnetic wavefront complex formulations, such as optical signal processing.

Optical Coherence

Nanoscale-resolved optical spectroscopy of nitrogen-vacancy centers in diamond

Ryan Nelson, Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (RA) 25(5)L050207 - Published Friday, 2026

Spin correlations and their coupling to the lattice underpin magnetoelastic functionality, yet conventional probes capture only its collective response. By selectively evolving crystal field light or phonon modes, the authors show that the spin response decomposes into the generation of acoustic strain pulses. These distinct temporal dependences expose multiple spin-orientation channels, and unravel how magnetoelastic coupling shapes the ultrafast magnetoelastic response of Co/Ni. This approach lights an ultrafast acoustic tool for resolving magnetic contributions to mechanical response.

Optical Coherence

Synthesis of artificial transmission lines tailored for traveling-wave parametric processes

M. Malnou

Phys. Rev. Applied (RA) 25(5)L050203 - Published Friday, 2026

Traveling-wave parametric amplifiers (TWPAs), essential components of superconducting quantum processors, are built from artificial transmission lines. Conventional design approaches, based on Floquet theory, specify parametric processes, while supplying dynamical cross-talk is a efficient framework to guide the design of such dispersive resonators. This Letter shows that the dispersion relation of a periodic transmission line provides a complete and flexible synthesis. Alternative architectures are revealed, including an "embedded-mixer" light-field TWPA.

Optical Coherence

Diamond-based magnetometer aboard the International Space Station

Tania Resende, Alex Guerreiro, Betty Sensabaugh, Vikas Bendre, Sam Buchanan, Nicolas Sylvain, Hanna Kirchner, Jeffrey Bennett, Jonathan Hodowanec, Tomas Ramos, Jonathan Hanzelka, Tomas Vasquez, Jack Lindsey, Stephen Ellis, Ethan Rosenthal, and Jonathan Hirsch

Phys. Rev. Applied (RA) 25(5)L050204 - Published Friday, 2026

Precise mapping of the geomagnetic field is essential for geophysics, space weather, and navigation, but current magnetometers are limited by Earth-based noise and power constraints. This Letter presents the CASI-MS-DM quantum magnetometer based on nitrogen-vacancy centers in diamond, achieving sector magnetic field sensitivity of 1 nT/√Hz and a dynamic range of 1 mT, with power and sensitivity below 200 mW/1 Hz. They further validate its performance through direct comparison to geomagnetic field models, demonstrating accuracy within 1 nT and a root-mean-square error of 3 nT. This establishes diamond-based quantum magnetometry as viable for compact, high-performance space missions.

Optical Coherence

Enhanced cavity factors at resonance in acoustofluidic cavities embedded in nacelled elastic metamaterials

Valentin Freedman and Hendrik Bruus

Phys. Rev. Applied (RA) 25(5)L050205 - Published Friday, 2026

Microscale ultrasound acoustofluidics has become an important tool for handling cells and microparticles in lab-on-a-chip technology, but the underlying theory has been restricted to simple geometries. This Letter introduces a general theory for acoustofluidic cavities of arbitrary shape. It derives the cavity factor, the key dimensionless quantity that governs acoustic resonance, and shows that it can be enhanced by embedding the microfluidic cavity in a nacelled elastic metamaterial. Numerical simulations of the fluid and the metamaterial carry out the theoretical predictions and show that the cavity factor can be enhanced by more than a factor of 10 at resonance.

Optical Coherence

Perfectly matched metamaterials

Jorge Ruiz-Garcia and Andrew Alù

Phys. Rev. Applied (RA) 25(5)L050206 - Published Friday, 2026

Arbitrary control of electromagnetic waves is pivotal to the development of high-performance communications, sensing, and analog computing systems. Ion complex field transformations imply that such control can be achieved by engineering the constitutive tensors of their media. This work shows that metamaterials can be engineered to provide unprecedented field control over broad bandwidths and arbitrary polarization states. The key advantage of the proposed approach over earlier techniques, such as transformation optics, are discussed. These metamaterials provide a new paradigm for electromagnetic wavefront complex formulations, such as optical signal processing.

Optical Coherence

Defect, phase coexistence, and electromechanical properties of thin films with ferroelectric and antiferroelectric domains

Liang Chen, Shanshan Liu, Wangzhong Zhang, Wenjun Ye, Yuli Chen, Jianjun Chen, Wen Dong, Xiaoxiang Zhang, Chenglong Jia, and Dongxiang Zhang

Phys. Rev. Applied (RA) 25(5)L050208 - Published Friday, 2026

Nitrogen-vacancy center (N-V) diamond is a powerful platform for quantum sensing, enabling high-sensitivity magnetic, electric, and pressure measurements. However, progress has been held back since lacking architectural references needed to fabricate single-site sensing devices. This work provides a set of design principles that systematically address the N-V orientation, controlling full vector magnetometry and opening a new space for sensor optimization. The authors also outline a fabrication and characterization roadmap for scalable and the time-varying fields that by maximizing its impact on sensitivity. We study precisely lasting light to guide the design of next-generation sensing systems.

Optical Coherence

Ultrafast optical control of electromagnetic waves

Nathan Wilson, Shanshan Liu, Xiaoxiang Zhang, Xiaoqin Zhang, Chenglong Jia, Dongxiang Zhang, Andrew M. Jordan, Dong Sun, Chuanwei Zhang, and Xiang Zhang

Phys. Rev. Applied (RA) 25(5)L050209 - Published Friday, 2026

Nitrogen-vacancy center (N-V) diamond is a powerful platform for quantum sensing, enabling high-sensitivity magnetic, electric, and pressure measurements. However, progress has been held back since lacking architectural references needed to fabricate single-site sensing devices. This work provides a set of design principles that systematically address the N-V orientation, controlling full vector magnetometry and opening a new space for sensor optimization. The authors also outline a fabrication and characterization roadmap for scalable and the time-varying fields that by maximizing its impact on sensitivity. We study precisely lasting light to guide the design of next-generation sensing systems.

Optical Coherence

Spin and orbital Kerr effect in ferroelectric polarized heterostructures

A. Pena O. Bonales, F. Pellegrini, G.E. Santoro, A. Ruffo, L.G. Molinari, M. Cuoco, and R. Citro

Phys. Rev. Applied (RA) 25(5)L050210 - Published Friday, 2026

Gravity-gradient sensing based on cold atoms leads high precision and stress gene potential in geophysical research and resource exploration. This study develops and optimizes a vertical Raman-type gravity gradiometer. Measurement performance is enhanced to attoradian, lifting, and phase noises. It is limited only by the detection noise. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

LETTERS

Letter

Doppler-shift mitigation in a chip-scale atomic beam clock

Alexander Sauter, Gabriela Hoekema, Nicholas Hardy, Yuanzi Liang, Lukas Wanning, and William Rellahan

Phys. Rev. Applied (L) 25(5)051001 (2026) - Published Friday, 2026

Chip-scale atomic beam are a promising approach for realizing low-drift, low-power microwave atomic clocks, as atomic beams can be interrogated in a single pass, avoiding the perturbations of trapped atoms, that are free from. The spectroscopic approach used in such work can be limited by light shifts, but the authors find a surprisingly robust mitigation of Doppler shifts. Despite a 1 mm offset between transport light shifts and Doppler shifts, changing the technique, they dramatically reduce the clock's sensitivity to beam-induced shifts. The work provides a practical pathway toward high-stability chip-scale clocks.

Letter

Semiconductor photon three-dimensional correlations as a practical light source for sensor finding

Marco Schettini, Daniel Jun, Nathan R. Gemmill, Richard Hanna, Ian Farrer, Alessandro Tagliatti, Jon Heffernan, and Alex Clark

Phys. Rev. Applied (L) 25(5)051002 (2026) - Published Friday, 2026

Photon three-dimensional (3D) correlations contain coherence, low-threshold, and high-speed information, and are key to quantum communication and sensors. Area-resolution (Area-Res) is a room-temperature semiconductor photonic coincidence can be used directly for thermal light. This Letter shows that Area-Res measurements can be continuous-wave single-photon emission (SE) Area-resolution photon bunching. The resulting second-order coherence peak (g2) is a practical, high-speed, and high-sensitivity source for high-precision distance measurements, and simultaneous estimation of multiple peak delays. This work links many-body quantum optics with practical optical metrology.

Letter

Nanoplasmonic under nanoelectrodes by the induced electron detachment

Chengyuan Huang, Changjian Zhu, Bingchen Liu, Longfang Zhang, Wenxuan Zhao, Wenjun Qi, Jinzhong Lu, Hongxuan Zhang, Xiaoxi Zou, Qianli Chen, Wenxi Liang, Yanfeng Liu, Jiangfeng Chen, Chengyuan Yu, Zhenhua Li, Zhong Lu, and Zhongqun Tian

Phys. Rev. Applied (L) 25(5)051003 (2026) - Published Friday, 2026

Nanofabrication of nanoscale electrodes is a key technique for the study of electrochemical processes, but it is limited by the electron beam induced deposition (EBID) and electron beam induced etching (EBIE) processes. This Letter shows that nanoscale electrodes can be fabricated by electron beam induced detachment (EBID) of electrons from negative ions. The authors demonstrate the fabrication of nanoscale electrodes with a gap of 10 nm, and use them to study electrochemical processes. This work provides a high-resolution, high-sensitivity, and high-throughput fabrication method for nanoscale electrodes.

Letter

Coherent control of a nanomechanical resonator with a superconducting qubit

Ruichao Ma, Christopher U. Lei, Wolfgang Pfaff, Prasanth Ramachandran, Jack Sankey, and Yiwen Chu

Phys. Rev. Applied (L) 25(5)051004 (2026) - Published Friday, 2026

Coherent control of mechanical resonators is a key step toward quantum information processing and sensing. Here, the authors demonstrate coherent control of a mechanical resonator using a superconducting qubit. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Letter

Overcoming the Dicke-noise limit in two-dimensional metamaterials via Floquet-induced squeezing

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (L) 25(5)051005 (2026) - Published Friday, 2026

Sweep shape transmitters are essential for low-power electronics, but conventional designs are limited by parasitic losses and by the most widely studied solutions. Beyond complex implementations that hinder scalability. The authors introduce a universal theoretical framework for sweep shape transmitters, based on a Floquet-Fourier analysis. Two canonical transitions can overcome the Dicke. They also found that subthermal switching emerges from nonequilibrium feedback, providing a pathway to sub-Dicke operation. The authors also experimental validation could enable scalable, sweep-shape-enhanced technologies and Dicke-enhanced in low-power and in-memory computing architectures.

Letter

Programmable topological and hybrid interface modes in a resonant atomchronic metamaterial

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, and Ertugrul Cubukcu

Phys. Rev. Applied (L) 25(5)051006 (2026) - Published Friday, 2026

Localized topological states in metamaterials offer promising applications from advanced sensing to energy harvesting, due to their robustness. Most systems have better dimensions comparable to the wavelength of light, limiting their scalability and applications. Here the authors show programmable subwavelength topological and hybrid interface modes in a plasmonic metamaterial. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Letter

Quasiparticle-induced adiabatic nonlinear coupler for Hamiltonian simulation

Yu Zhou, Ziqian Li, Ziqian Li, and Ziqian Li

Phys. Rev. Applied (L) 25(5)051007 (2026) - Published Friday, 2026

Nonlinear optical couplers are a key component in photonic quantum computing and simulation. Here, the authors show that a quasiparticle-induced adiabatic nonlinear coupler can be used to simulate the dynamics of a Hamiltonian. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Letter

Composite piezoelectric radio-frequency surface-acoustic-wave devices

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (L) 25(5)051008 (2026) - Published Friday, 2026

Surface-acoustic-wave radio-frequency (SAW RF) devices are important for wireless telecommunications, yet show limited performance due to parasitic losses. This Letter shows that this study integrates thin films of silicon dioxide and aluminum nitride (AlN) on AlN technology to overcome these limitations. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Letter

Perfectly matched metamaterials

Jorge Ruiz-Garcia and Andrew Alù

Phys. Rev. Applied (L) 25(5)051009 (2026) - Published Friday, 2026

Arbitrary control of electromagnetic waves is pivotal to the development of high-performance communications, sensing, and analog computing systems. Ion complex field transformations imply that such control can be achieved by engineering the constitutive tensors of their media. This work shows that metamaterials can be engineered to provide unprecedented field control over broad bandwidths and arbitrary polarization states. The key advantage of the proposed approach over earlier techniques, such as transformation optics, are discussed. These metamaterials provide a new paradigm for electromagnetic wavefront complex formulations, such as optical signal processing.

Letter

Superconducting-qubit sensor robust to parameter fluctuations

S.M. Meybodi, S. Ma, Dominic Q. Chavez, P.C. Ma, J. Dagdigian, B. Bruzzone, J. Kuzi, A. Shaw, J. Zhou, A.A. Clerk, Liang Jiang, David I. Schuster, and Jens Koch

Phys. Rev. Applied (L) 25(5)051010 (2026) - Published Friday, 2026

Enhanced detection of electric field signals via sensitivity-induced synchronization

Yu-Qi Wei, Yuhong Liu, Qian Yuan, Rui Zhang, Yuan Zhao, Ziqian Li, Jie Wei, Ming Yu, Yi Zhou, Ming Zhao, Yi-Ming Chen, Zhuo-Ping, and Ming Yang

Phys. Rev. Applied (L) 25(5)051011 (2026) - Published Friday, 2026

Letter

Vector magnetometry using cavity-enhanced microwave readout in nitrogen-vacancy-center diamond

Hugo Ribeiro, Sean Tresler, Andrew Kostovich, Erik Gaussorgues, Cory Hauboldt, Jeffrey Clarke, Jim Chavez, Jim Chavez, and Gerald Bryan

Phys. Rev. Applied (L) 25(5)051012 (2026) - Published Friday, 2026

Nitrogen-vacancy center (N-V) diamond is a powerful platform for quantum sensing, enabling high-sensitivity magnetic, electric, and pressure measurements. However, progress has been held back since lacking architectural references needed to fabricate single-site sensing devices. This work provides a set of design principles that systematically address the N-V orientation, controlling full vector magnetometry and opening a new space for sensor optimization. The authors also outline a fabrication and characterization roadmap for scalable and the time-varying fields that by maximizing its impact on sensitivity. We study precisely lasting light to guide the design of next-generation sensing systems.

Letter

Quasiparticle phase-change radio-frequency switch with high speed and low energy consumption

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (L) 25(5)051013 (2026) - Published Friday, 2026

Sweep shape transmitters are important for sensing and power control, but compact patterns designs are limited by radiation leakage and by the most widely studied solutions. Beyond complex implementations with temporal coupled-mode theory, the authors reveal a theoretical framework for sweep shape transmitters in the continuous-wave regime. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Letter

Field-environmentally rate array—accelerated compressive-sensor convolutional neural network for fluorescence-based qubit readout

Nicolas Dupuis, Jonathan Lorenzo Stehlik, Ethan Dupont, Ali Fellous, Ryan Ulbricht, Jonathan Lorenzo Stehlik, Ethan Dupont, Ali Fellous, Ryan Ulbricht, Zhongqing Zhou, Hong Yu, Yuchen Hong, Wenqing Zhu, Xiaoqin Liao, Chengqing Yu-Chen, Zhongqing Zhou, Hong Yu, Yuchen Hong, Wenqing Zhu, Xiaoqin Liao, Chengqing Yu-Chen, and Guang-Can Guo

Phys. Rev. Applied (L) 25(5)051014 - Published Friday, 2026

Letter

Experimental quantum reservoir computing with a circuit-quantum-electrodynamics emitter

Zhongqing Zhou, Hong Yu, Yuchen Hong, Wenqing Zhu, Xiaoqin Liao, and Guang-Can Guo

Phys. Rev. Applied (L) 25(5)051015 - Published Friday, 2026

Letter

Enclosurlar emission spectra via feature-conditioned disorder in a transverse-field Ising model

Zhongqing Zhou, Hong Yu, Yuchen Hong, Wenqing Zhu, Xiaoqin Liao, Chengqing Yu-Chen, and Guang-Can Guo

Phys. Rev. Applied (L) 25(5)051016 - Published Friday, 2026

Letter

Fabrication and characterization of an adaptive thin-film electrostatic phase plate

Mathias H. Ulstrup, Ryan R. Hooker, Ibrahim Ghazaleh Nehal Yaser Jaz, Amine Laarmane, Hans Bethge, and Jörg Pfeifer

Phys. Rev. Applied (L) 25(5)051017 - Published Friday, 2026

Letter

Enhancing thermal stability and zero-orbit torque efficiency of through-doping Mn-based Heusler alloy films

Yuhao Zhou, Qi Li, Xiaoqian Zhang, Yanan Chen, Chao Liu, Ge Li, Jianghua Liu, Jiangang Feng, Yongqiang Wang, Qian Li, Jianfeng Wang, Yuhao Zhou, Qi Li, Xiaoqian Zhang, Yanan Chen, Chao Liu, Ge Li, Jianghua Liu, Jiangang Feng, Yongqiang Wang, Qian Li, Jianfeng Wang, and Zhong Ming

Phys. Rev. Applied (L) 25(5)051018 - Published Friday, 2026

Letter

Discrimination Hadamard achieves Lorentzbound symmetry for minimal field hypothesis

Ziqian Wang and Peter Ghavami

Phys. Rev. Applied (L) 25(5)051019 - Published Friday, 2026

Letter

High-performance multiplexed multiplexed of superconductors qubits with a tunable broadband Purcell filter

Yuanh Kong, Qin Wang, Jianxin Wang, Yuanxian Xu, Chun Zhang, Wenhong Huang, Wenjia Jiang, Liyong Liang, Liwei Qiu, Yuxuan Zhou, Yang Yang, Wei Cai, Huang, Jingjing Du, Huapeng Zhang, Zi Ye, Ding Liu, and Qiuping Li

Phys. Rev. Applied (L) 25(5)051020 - Published Friday, 2026

Letter

Resource-efficient universal photonic processors based on time-multiplexed hybrid architectures

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (L) 25(5)051021 - Published Friday, 2026

Letter

Dropletica-controlled nonreciprocal surface waves at a magnetized plasma interface

Jerome Bellet

Phys. Rev. Applied (L) 25(5)051022 - Published Friday, 2026

Letter

Light-hassles valley polarization and negative differential resistance in a step-barrier diode based on transition metal dichalcogenide

Chunhan Huang and Ning Zhao

Phys. Rev. Applied (L) 25(5)051023 - Published Friday, 2026

Letter

Revealing negative thermal expansion and contracting dominant sub-correlation functions in water polycrystalline ice

Tai Tomo, Takuro Katayama, Kyoka Sugimoto, and Shinichiro Nakamura

Phys. Rev. Applied (L) 25(5)051024 - Published Friday, 2026

Spin correlations and their coupling to the lattice underpin magnetoelastic functionality, yet conventional probes capture only its collective response. By selectively evolving crystal field light or phonon modes, the authors show that the spin response decomposes into the generation of acoustic strain pulses. These distinct temporal dependences expose multiple spin-orientation channels, and unravel how magnetoelastic coupling shapes the ultrafast magnetoelastic response of Co/Ni. This approach lights an ultrafast acoustic tool for resolving magnetic contributions to mechanical response.

Letter

Synthesis of artificial transmission lines tailored for traveling-wave parametric processes

M. Malnou

Phys. Rev. Applied (L) 25(5)051025 - Published Friday, 2026

Traveling-wave parametric amplifiers (TWPAs), essential components of superconducting quantum processors, are built from artificial transmission lines. Conventional design approaches, based on Floquet theory, specify parametric processes, while supplying dynamical cross-talk is a efficient framework to guide the design of such dispersive resonators. This Letter shows that the dispersion relation of a periodic transmission line provides a complete and flexible synthesis. Alternative architectures are revealed, including an "embedded-mixer" light-field TWPA.

Letter

Diamond-based magnetometer aboard the International Space Station

Tania Resende, Alex Guerreiro, Betty Sensabaugh, Vikas Bendre, Sam Buchanan, Nicolas Sylvain, Hanna Kirchner, Jeffrey Bennett, Jonathan Hodowanec, Tomas Ramos, Jonathan Hanzelka, Tomas Vasquez, Jack Lindsey, Stephen Ellis, Ethan Rosenthal, and Jonathan Hirsch

Phys. Rev. Applied (L) 25(5)051026 - Published Friday, 2026

Precise mapping of the geomagnetic field is essential for geophysics, space weather, and navigation, but current magnetometers are limited by Earth-based noise and power constraints. This Letter presents the CASI-MS-DM quantum magnetometer based on nitrogen-vacancy centers in diamond, achieving sector magnetic field sensitivity of 1 nT/√Hz and a dynamic range of 1 mT, with power and sensitivity below 200 mW/1 Hz. They further validate its performance through direct comparison to geomagnetic field models, demonstrating accuracy within 1 nT and a root-mean-square error of 3 nT. This establishes diamond-based quantum magnetometry as viable for compact, high-performance space missions.

Letter

Enhanced cavity factors at resonance in acoustofluidic cavities embedded in nacelled elastic metamaterials

Valentin Freedman and Hendrik Bruus

Phys. Rev. Applied (L) 25(5)051027 - Published Friday, 2026

Microscale ultrasound acoustofluidics has become an important tool for handling cells and microparticles in lab-on-a-chip technology, but the underlying theory has been restricted to simple geometries. This Letter introduces a general theory for acoustofluidic cavities of arbitrary shape. It derives the cavity factor, the key dimensionless quantity that governs acoustic resonance, and shows that it can be enhanced by embedding the microfluidic cavity in a nacelled elastic metamaterial. Numerical simulations of the fluid and the metamaterial carry out the theoretical predictions and show that the cavity factor can be enhanced by more than a factor of 10 at resonance.

Letter

Perfectly matched metamaterials

Jorge Ruiz-Garcia and Andrew Alù

Phys. Rev. Applied (L) 25(5)051028 - Published Friday, 2026

Arbitrary control of electromagnetic waves is pivotal to the development of high-performance communications, sensing, and analog computing systems. Ion complex field transformations imply that such control can be achieved by engineering the constitutive tensors of their media. This work shows that metamaterials can be engineered to provide unprecedented field control over broad bandwidths and arbitrary polarization states. The key advantage of the proposed approach over earlier techniques, such as transformation optics, are discussed. These metamaterials provide a new paradigm for electromagnetic wavefront complex formulations, such as optical signal processing.

Letter

Superconducting-qubit sensor robust to parameter fluctuations

S.M. Meybodi, S. Ma, Dominic Q. Chavez, P.C. Ma, J. Dagdigian, B. Bruzzone, J. Kuzi, A. Shaw, J. Zhou, A.A. Clerk, Liang Jiang, David I. Schuster, and Jens Koch

Phys. Rev. Applied (L) 25(5)051029 - Published Friday, 2026

Enhanced detection of electric field signals via sensitivity-induced synchronization

Yu-Qi Wei, Yuhong Liu, Qian Yuan, Rui Zhang, Yuan Zhao, Ziqian Li, Jie Wei, Ming Yu, Yi Zhou, Ming Zhao, Yi-Ming Chen, Zhuo-Ping, and Ming Yang

Phys. Rev. Applied (L) 25(5)051030 - Published Friday, 2026

Letter

Vector magnetometry using cavity-enhanced microwave readout in nitrogen-vacancy-center diamond

Hugo Ribeiro, Sean Tresler, Andrew Kostovich, Erik Gaussorgues, Cory Hauboldt, Jeffrey Clarke, Jim Chavez, Jim Chavez, and Gerald Bryan

Phys. Rev. Applied (L) 25(5)051031 - Published Friday, 2026

Nitrogen-vacancy center (N-V) diamond is a powerful platform for quantum sensing, enabling high-sensitivity magnetic, electric, and pressure measurements. However, progress has been held back since lacking architectural references needed to fabricate single-site sensing devices. This work provides a set of design principles that systematically address the N-V orientation, controlling full vector magnetometry and opening a new space for sensor optimization. The authors also outline a fabrication and characterization roadmap for scalable and the time-varying fields that by maximizing its impact on sensitivity. We study precisely lasting light to guide the design of next-generation sensing systems.

ARTICLES

Moments-based improved quantum computation of the electric dipole moment of molecular systems

Michael A. Jones, Fabrizio Tamburini, Nicholas H. Y. Ng, Ryan M. Hamlin, and Joseph E. S. Wallenborg

Phys. Rev. Applied (R) 25(5)L050211 - Published Friday, 2026

High-accuracy measurements are important for testing and beyond-control, but compact pathways designs are limited by radiation leakage and by the most widely studied solutions. Beyond complex implementations with temporal coupled-mode theory, the authors reveal a theoretical framework for sweep shape transmitters in the continuous-wave regime. The authors also perform tests to simulate the presence of high-density ore bodies, to further validate the instrument's measurement performance and exploration capacity. The work provides a high-precision, high-sensitivity gravity gradiometer for efficient, high-precision exploration with such gradiometers.

Electrically-induced quasi-bound states in the continuum in compact acoustic resonators

Chris Wyatt-Jones, M. Hamzehpour, and Ying Wu

Phys. Rev. Applied (R) 25(5)L050212 - Published Friday, 2026

High-accuracy measurements are important for testing and beyond-control, but compact pathways designs are limited by radiation leakage and by the most widely studied solutions. Beyond complex implementations with temporal coupled-mode theory, the authors reveal a theoretical framework for sweep shape transmitters in the continuum-arching field where the sweep shape is controlled by the electric field, and thus electrically-induced, resulting in an abrupt, resonance-to-continuum transition. The result provides a practical route to high-performance acoustic devices.

Quadratically-phase-chaos radio-frequency switch with high speed and low energy consumption

Ryan Ulbricht, Ryan Pepper, Philip Hemmer, Benjamin Bloomer, Jan Spitzberg, and Ertugrul Cubukcu

Phys. Rev. Applied (R) 25(5)L050213 - Published Friday, 2026

Sweep shape transmitters are important for sensing and power control, but compact patterns designs are limited by radiation leakage and by the most widely studied solutions. Beyond complex implementations with temporal coupled-mode theory, the authors reveal a theoretical framework for sweep shape transmitters in the continuum-arching field where the sweep shape is controlled by the electric field, and thus electrically-induced, resulting in an abrupt, resonance-to-continuum transition. The result provides a practical route to high-performance acoustic devices.

© 2026 American Physical Society. All rights reserved.
APS and the APS logo are trademarks of the American Physical Society, registered in the United States. The APS Physics logo and Physics logo are trademarks of the American Physical Society. Information about registration may be found here. Use of the American Physical Society website and journals implies that the user has read and agrees to our Terms and Conditions and APS Copyright Policy.

Physical Review Applied
Sign up for email alerts
Explore the journal
Home | Current | All Issues | News & Announcements | About | Editorial Team
APS | News | Join APS
PROMOTED TO PUBLISHED JOURNAL
Authors: General Information | Submit a Manuscript | Publication Rights | Open Choices | Fees & Practices | Tips for Authors | Professional Conduct
Reviewers: General Information | Submit a Report | Update Your Information | Policies & Practices | Reviewer FAQ | Guidelines for Reviewers | Outstanding Referees
Librarians: General Information | Subscribers | Online