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Interfacial W–O–Zr ensembles in tungstated zirconia catalysts enable efficient hydrogen-free recycling of polypropylene waste
Chemical recycling of plastics often requires harsh conditions, costly hydrogen, noble metals, or complex catalysts with challenging design. Here, the authors report hydrogen- and solvent-free depolymerization of polypropylene consumer goods at mild temperatures, achieving >80% yield into gasoline hydrocarbons with stable performance.
Sibei Zou, Yuzhen Ge & Javier Pérez-Ramírez

Article
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Thermal transport through molecular monolayers in plasmonic nanogaps
Thermal conduction of single molecule layers has been extremely difficult to measure. Here, the authors use a transient optical technique on precision-assembled nanostructures to characterise different molecular spacers.
Fiona Bell, Erfan Norouzi Farahani & Jeremy J. Baumberg

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Reentrant Landau levels in a Dirac topological insulator
Pentatellurides exhibit magnetoresistance oscillations that deviate from conventional 1/B Landau-quantization. Here, the authors demonstrate robust non-1/B oscillations in $ZrTe_5$ and show that nonlinear Landau level backbending reconciles the diverse oscillatory regimes across the pentatellurides.
C. Kaufmann Ribeiro, J. C. Mutch & J. C. Palmstrom

Article
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Neighbouring group participation hindered by force as a molecular design for covalent catch bonds
Catch bonds—dynamic molecular interactions whose lifetimes increase under mechanical load—are central to biological mechanotransduction but remain challenging to replicate synthetically. Here, the authors report a covalent catch-bonding mechanism in a low-molecular-weight motif based on hydroxyethyl phosphate triesters.
Soumabrata Majumdar, Diederik van Luijk & Rint P. Sijbesma

Article
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Ultrahigh charge utilization of C–C bridge-dependent MOF@COFs empowering sustainable removal of trace pharmaceuticals
Charge recombination hampers the effectiveness of photocatalysis in decontamination. A versatile strategy to design MOF@COFs enables the ultrahigh charge utilization for swift $\bullet O_2^-$ generation, accomplishing sustainable pharmaceuticals removal.
Suxin Zhou, Cheng Mao & Gangfeng Ouyang

Article
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Approaching-unity PLQY and high stretchability in polymer emitters via molecular spacers
Overcoming the tradeoff between mechanical stretchability and emitting efficiency for stretchable organic light emitting diodes (OLED) is a challenge. Here, the authors use small-molecule plasticizers as molecular spacers in TADF polymers, enabling approaching-unity PLQY and improved efficiency in stretchable OLEDs.
Glingna Wang, Wei Liu & Sihong Wang

Article
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Four-dimensional reconfigurable vascular tunneling machine of spatially programmed liquid crystal elastomers
Soft robotics are promising to maneuver through complex environments, though it is challenging to design adaptable devices. Here the authors use a liquid crystal elastomer-based system to design a tunneling robot which can disrupt clogs in a model vascular system.
Yi Li, Yuan Gao & Junshan Liu

Article
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Coulombic control of charge transfer in radicals with quartet recycling luminescence
thanks Xian-Kai Chen, Yoshio Teki, and the other, anonymous, reviewer(s) for their contribution to the peer review of this work. A peer review file is available.
Lujo Matasovic, Petri Murto & Sebastian Gorgon

Article
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A transparent PVA-based polymer sunscreen protects retinal tissue from ultraviolet damage
Ultraviolet light damages the eye, yet safe and effective sunscreens for the eye are lacking. Here the authors show that a modified PVA-syringaldehyde polymer provides high UV protection with minimal irritation, preserving retinal structure and vision in zebrafish and mouse models.
Siyu Pan, Sa Du & Lei Tao

Article
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Interfacial dipolar interactions drive giant second-harmonic generation in 2D organic–inorganic heterostructures
Here, the authors report that the coherent interfacial coupling between α-perylene molecular crystals and WS_2 gives rise to a giant second-harmonic generation (SHG) response, resulting in a ~ 650-fold enhancement in monolayers and robust activation of SHG in bilayers.
Ye-Tao Chen, Shi-Yi Yuan & Jun Yi

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Operando X-ray scattering reveals ordering-mediated solidification in additive manufacturing
Operando X-ray pair distribution function measurements reveal how atomic ordering in liquid metals governs solidification during laser additive manufacturing, providing direct atomic-scale insight into melt pool dynamics and microstructure control.
Lin Gao, Kyle Mumm & Tao Sun

Article
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Oxygen-induced multimodal ultramicroporous structure in 10-nm-thick carbon membranes for enhanced hydrogen separation
Researchers develop 10-nm-thick carbon membranes with oxygen-induced multimodal pore structures that enable rapid, selective and thermally stable hydrogen separation.
Yueqing Shen, Cédric Van Goethem & Kumar Varoon Agrawal

Article
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Triple-interlocked-nanotwinned bulk magnesium alloys with exceptional strength and ageing resistance
Nanotwinned materials are promising for structural applications. Here, a triple-interlocked-nanotwinned strategy via martensitic transformation is used to overcome intrinsic twin engineering deficiencies and achieve excellent mechanical properties.
Qiuming Peng, Lutong Zhou & Yongjun Tian

Article
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Nickel/Photoredox-catalyzed diastereoselective semihydrogenation of alkynes using a carboxylic acid as a cooperative ligand and hydrogen surrogate
The Z-selective semihydrogenation of alkynes plays a key role in the industrial manufacture of fine chemicals. Here, the authors report the efficient and diastereoselective semihydrogenation of alkynes to Z-alkenes through synergistic nickel/photoredox catalysts.
Jiaqian Zhang, Na Zhang & Chengfeng Xia

Article
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Total syntheses of (+)-dalesconols A and B enabled by triple-relayed remote chirality transfer
Natural products with densely fused polycyclic frameworks, such as dalesconols A and B, pose longstanding challenges for asymmetric synthesis due to their intricate stereochemistry. Here, the authors report concise, enantioselective total syntheses via a triple-relayed remote chirality transfer strategy using palladium/norbornene catalysis.
Yun Guo, Jingjing Liu & Xinjun Luan

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An autonomous single-actuator UAV with omnidirectional field of view, high agility, and collision resistance
The authors showcase a single actuator unmanned aerial vehicle (UAV), named PULSAR II, that demonstrates full three dimensional maneuverability and natural self rotation, enabling omnidirectional LiDAR sensing and eliminating unobserved areas.
Nan Chen, Haotian Li & Fu Zhang

Article
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Room-temperature memristive switching between charge density wave states
Electrically controlled non-volatile resistance switching involving charge density wave states is rare and has been constrained to cryogenic temperature to date. Venturini et al. show the room-temperature electrical control of the charge-density-wave order in $EuTe_4$, holding promise for memory devices.
R. Venturini, M. Rupnik & D. Mihailovic

Article
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Hybrid ferroelectric-ionic memristive hardware for high scalability in-memory computing
While large-scale memristor arrays hold promise for ever-growing need of data processing, their scalability remains limited. Kim et al. report a hybrid memristor that combines the switching and rectification behaviors of tunnel junctions and diodes, resulting in a storage capacity of 10 Gb.
Jeong-Han Kim, Wonjun Shin & Daewoong Kwon

Article
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A self-reliance framework for identifying strategic advanced materials
Global uncertainty demands technological sovereignty. The authors define 'strategic advanced materials' as those that achieve high-performance using local inputs, showing Europe can replace risky imports with resilient, home-grown alternatives.
Cristina Teixeira, Cian Gabbett & Adam G. Kelly

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Single-molecule electrical characterization of photoinduced aggregation evolution
Elucidating the structural evolution of photoinduced molecular aggregation in solution remains challenging. Zhu *et al.* employ persulfurated arenes as a model system to characterize this process, introducing an electrical approach for probing photoresponsive aggregation at the single-molecule level.
Rongqin Zhu, Xiaoyan Xu & He Tian

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Laser-driven ferroelectricity in $SrTiO_3$ via quantum fluctuation quenching
Strong laser driving of $SrTiO_3$ suppresses quantum lattice fluctuations, inducing ferroelectric order. The study reveals a general mechanism to control structural phases in quantum materials with light.
Francesco Libbi, Lorenzo Monacelli & Boris Kozinsky

Article
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Starvation effect enables computing and memory functions in semiconductor-free fibres
Fibre-based switchable devices are limited by specialised patterning techniques needed for semiconductor materials. Here, the authors two semiconductor-free four-terminal switchable ionic fibres enabled by a nanoscale-level ion starvation mechanism.
Xuhui Zhou, Lei Huang & Lei Wei

Article
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Unravelling the bi-functional role of cation-regulated surface hydroxyl kinetics in Pt-catalyzed alcohol fuel cells
Alcohol oxidation plays a crucial role in renewable energy, but its efficiency is typically limited by complex surface dynamics. Here, the authors show that alkali metal cations modulate hydroxyl adsorption on platinum-based catalysts, achieving a kinetic balance that boosts performance.
Zhangyan Mu, Zhibin Ma & Mengning Ding

Article
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Selective radial thickness growth of compositionally graded shells on colloidal quantum rods for more efficient light-emitting diodes
Colloidal quantum rods can emit polarized light but suffer from uneven shell growth. Here, the authors employ a dual-ligand strategy to selectively grow compositionally graded shells in radial thickness, yielding LEDs with an efficiency of 32%.
Yicheng Zeng, Xiaonan Liu & Hongbo Li

Article
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Pixelated electrically driven Sb_2Se_3 phase-change metasurfaces
Phase-change materials cannot be easily integrated into electrically driven metasurfaces. Here, the authors develop a monolithically integrated Sb2Se3 phase-change metasurface composed of a 6 × 6 pixel array, enabling high-speed and broadband control over the phase and amplitude of light.
Siqing Zeng, Yuru Li & Din Ping Tsai

Article
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Digital adiabatic evolution is universally accurate
In this study, the authors show that digital adiabatic evolution is highly robust to simulation errors. Rather than accumulating, these errors self-cancel and even decrease over time, enabling highly efficient algorithms on near-term and future quantum computers.
Yangyu Lu, Yifei Huang & Xiao Yuan

Article
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Accelerating molecular dynamics simulations using fast Ewald summation with prolates
Long-range electrostatic calculations are an expensive step in molecular dynamics simulations. Here, the authors introduce Ewald summation with prolates (ESP), which accelerates this step by up to tenfold, and implement it in open-source packages LAMMPS and GROMACS.
Jiuyang Liang, Libin Lu & Shidong Jiang

Article
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Cascade of magnetic-field-induced quantum spin states in a spin-1 honeycomb magnet
The honeycomb antiferromagnet $Na_3Ni_2BiO_6$ has been shown to exhibit a one-third magnetization plateau. Here, the authors identify multiple quantum phases both inside and beyond the field-induced one-third magnetization plateau in $Na_3Ni_2BiO_6$.
Kaixin Tang, Zhao-Yang Dong & Xianhui Chen

Article
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(3*R*, 7*S*)-11-hydroxy-jasmonic acid is a major oxidative shunt product of jasmonic acid catabolism in *Arabidopsis thaliana*
This study identifies 11-OH-JA, not 12-OH-JA, as the major JOX-derived shunt product accumulating in wounded Arabidopsis. 11-OH-JA does not bind the COI1-JAZ co-receptor, redefining JA catabolism as a deactivation pathway.
Kotaro Matsumoto, Maria Mitsui & Minoru Ueda

Article
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Full scale optimization of an anaerobic/aerobic/anoxic process for nitrogen removal from low-strength municipal wastewater
Authors report an optimized full-scale anaerobic/aerobic/anoxic process for low-strength municipal wastewater, achieving advanced nitrogen removal and reduced energy, chemical, and sludge outputs by regulating air-water ratio and hydraulic retention times.
Zeming An, Xinjie Gao & Yongzhen Peng

Article
21 May 2026 | Open Access
Differentiable land model reveals global environmental controls on latent ecological functions
Plants exhibit global patterns shaped by environment and evolution, yet how vegetation traits organize to produce observed ecological functions remains unclear. This study introduces DifferLand, which learns global environment–trait relationships from observations, reveals latent axes of ecological function, and improves the spatial generalization of carbon–water fluxes.
Jianing Fang, Kevin Bowman & Pierre Gentine

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Global protein-ligand binding affinity profiling via photocatalytic labeling
Profiling ligand-protein binding affinities across the proteome remains difficult. Here, the authors report Affinity Map, a photocatalytic labeling platform that accurately measures binding affinities for small molecules, peptides, and proteins in cell lysates, organ extracts, and live cell surfaces.
Charles D. Warren, Noah Yardeny & Jacob B. Geri

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Localized carbon deposition enables trimming of photonic integrated circuits
Researchers demonstrate precise post-fabrication adjustment of on-chip photonic devices using localized carbon deposition, offering a way to compensate for device variations caused by fabrication imperfections.
Rongyang Xu, Zhongyu Tang & Shabnam Taheriniya

Article
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Self sustained oscillations of a nonlinear optomechanical system in the low excitation regime
Nonlinear dynamics typically require high driving powers, while quantum effects appear at low excitation levels. Here, the authors observe and model self-sustained oscillations in cavity electromechanics at the few-photon level, using a Kerr cavity to reduce the threshold for nonlinear dynamics.
Shivangi Dhiman, Korbinian Rubenbauer & Hans Huebl

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Over four minutes of pyruvate T_1 using chemically and physically induced deceleration of relaxation
The polarization lifetime of hyperpolarized [$1-^{13}C$]pyruvate is extended to over four minutes by a combination of additives, deuteration, degassing, and optimized magnetic field, more than doubling metabolic sensitivity in cell experiments.
Josh P. Peters, Florin Teleanu & Andrey N. Pravdivtsev

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Superconductivity in kagome metals due to soft loop-current fluctuations
The authors propose that superconductivity in AV3Sb5 kagome materials is driven by soft, loop current fluctuations. They find that loop currents involving both V and Sb orbitals favor s ± pairing, while loop currents involving primarily V orbitals favor chiral d + id pairing.
Daniel J. Schultz, Grgur Palle & Jörg Schmalian

Comment
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Revisiting necessity of high-entropy electrocatalysts
High-entropy alloys are often presumed stable and intrinsically beneficial for electrocatalysis. This Comment argues that in situ structural evolution can diminish configurational entropy, necessitating rigorous identification of active phases under operando conditions before attributing catalytic performance to high-entropy effects.
Jiali Wang, Feng-Ze Tian & Hao Ming Chen

Article
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Entanglement area law in interacting bosons from the Bose-Hubbard model to $\phi 4$ theory and beyond
Entanglement area law has been established in systems with short range interactions and bounded local energy. Here the authors extend the proof to 1D bosonic systems with long-range interactions and unbounded local energy and outline implications for matrix product state approximations of the ground states.
Donghoon Kim & Tomotaka Kuwahara

Article
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Digital twin-driven fault diagnosis of power substations by multi-modal fusion learning
The study builds a digital twin of a power substation and combines topology, alarms, waveforms, and measurements using attention-based graph models to diagnose fault location, fault type, and protection failures with robust performance under noise and missing data.
Yulun Wu, Ying Chen & Lifu Ding

Article
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Direct measurement of Criegee intermediates in isoprene ozonolysis
Isoprene dominates tropospheric unsaturated hydrocarbons. This work reports the direct detection of Criegee intermediates in isoprene ozonolysis, resolving a persistent challenge and providing key constraints on atmospheric oxidation chemistry.
Lei Yang, Katia Hatem & Jingsong Zhang

Article
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NN-xTB: density functional accuracy at semi empirical speed with neural network extended tight binding
This work introduces a paradigm where neural networks predict parameters of a quantum semi-empirical Hamiltonian rather than energies directly, achieving DFT accuracy for relative energies, forces, vibrations, and geometries at semi-empirical cost.
Yufan Xia, Albert Thie & Giuseppe M. J. Barca

Article
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Computing efficiently in QLDPC codes
Quantum LDPC codes can shield quantum computers from decoherence with minimal overhead. In this work, the authors describe a new QLDPC family, SHYPS, as a path to practical fault tolerance with efficient Clifford circuit implementation on encoded states.
Alexander J. Malcolm, Andrew N. Glaudell & Stephanie Simmons

Article
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Higher odd-order nonlinear Hall effect in magnetic topological insulator $Mn(Bi_{1-x}Sb_x)_2Te_4$
We've seen reports on higher-order nonlinear Hall effects, including second- and third-order effects. Here, the authors report on higher odd-order nonlinear Hall effects up to seventh-order in $Mn(Bi_{1-x}Sb_x)_2Te_4$ thin flakes and theoretically indicate they may arise from Berry curvature multipoles.
Xiubing Li, Zheng Dai & Fengqi Song

Article
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Universal topology of exceptional points in nonlinear non-Hermitian systems
Exceptional points (EPs) are non-Hermitian degeneracies across various physical systems, including nonlinear ones. Here, by using catastrophe theory, the authors demonstrate a universal topology applicable to nonlinear systems that support second-order linear EPs. This framework provides a useful guide for future experimental applications of nonlinear EPs and their classification.
Nai-Hang Kwong, Jan Wingenbach & Rolf Binder

Article
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Long-range electronic interactions of tubular single-atom Cu-N_3 catalysts for nanoconfined direct electron transfer oxidation
Atomically dispersed catalysts that enable selective nonradical oxidation can overcome the short lifetimes and poor selectivity of radical-based water treatment processes. Here, the authors combine long-range electronic modulation with nanoconfinement by embedding isolated Cu–N_3 sites in carbon-doped tubular carbon nitride, demonstrating strong potential for water purification.
Huchuan Yan, Bisheng Li & Cui Lai

Article
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Ultrafast switching and high-endurance nonvolatile memory enabled by intrinsic switchable polarization in semiconducting Janus monolayers
The authors report the realization of switchable polarization field-effect transistors based on monolayer Janus MoSeS, showing on/off ratios exceeding 10^6 at zero gate bias, retention times up to 10,000 seconds, endurance of over 10^7 cycles, programming response times down to 16.5 ns and power consumption down to 113.9/89.8 fJ per program/erase cycle.
Ngoc Thanh Duong, Swathi Krishna & Seong Chu Lim

Article
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Click-like Aldol Polycondensation in air for plastic electronics and beyond
Traditional routes to conjugated polymers utilize C–C cross couplings, requiring expensive metal-based catalysts and oxygen free conditions. Here, the authors describe a click-like Aldol polycondensation route, enabling the rapid synthesis of conjugated polymers under mild, oxygen tolerant conditions using Lewis acid catalysts.
Hongru Chen, Hongyuan Fu & Yongfang Li

Article
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Selective deoxygenative bis- and monoborylation of carboxylic esters via boryloxy chromium–carbenes
Fischer-type metal carbenes are indispensable intermediates in synthesis but are traditionally accessed using stoichiometric chromium and hazardous reagents. Here, the authors report a catalytic route to boryloxy chromium–carbene complexes from esters, enabling ligand-controlled formation of mono- or bisboryl alkanes.
Xiaoyu Zhang, Yan Zhang & Xiaoming Zeng

Article
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Vibration-assisted fabrication of thin shells with spatially distributed imperfections
The study presents a vibration-assisted method to fabricate thin shells with tunable, spatially distributed thickness imperfections, showing that vibration mode shapes can be imprinted and controlled, significantly affecting the shells' buckling behaviour.
Ilyes Krida, Jacob Tang & Tian Chen

Article
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Free-form thermal cloaks in three dimensions
Physical realization of 3D omnidirectional thermal cloaking of arbitrarily objects with record-breaking complexity by integrating of 3D graded lattice microstructure, a 3D de homogenization technique, and additive manufacturing.
Weichen Li, Yibo Wang & Xiaojia Shelly Zhang

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Article
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Optimising DNA origami assembly by reducing off-target interactions

Off-target binding can result in kinetic traps reducing the efficiency of DNA origami assembly. Here, the authors develop a software tool to design scaffold & staples with chosen sequences to avoid unwanted molecular interactions, yielding stronger, more uniform nanostructures.

Ben Shirt-Ediss, Emanuela Torelli & Natalio Krasnogor

Article
26 May 2026 | Open Access
A general method for synthesizing heteropore covalent organic framework membranes to rapidly enrich uranyl ions

Heteropore covalent organic framework membranes have excellent uranium extraction capabilities, but their fabrication with well-defined hierarchical pores remains challenging. Here, the authors describe the pre-coating of covalent organic framework nanoparticles onto a nylon substrate as a general method for the preparation of heteropore covalent organic framework membranes.

Yue Zheng, Wanying Chen & Guangshan Zhu

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Giant spin-orbit magnetic state readout enhanced by a magnetic tunnel junction

This work proposes an MTJ-enhanced magnetoelectric spin-orbit (MESO) logic architecture for giant spin-orbit magnetic state readout. The device achieves a room-temperature output voltage up to 1.5 mV and instant and efficient data exchange between computing and memory units.

Yan Huang, Kun Zhang & Weisheng Zhao

Article
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Skin-mimicking biogel-based iontronic sensor with hierarchical bionic coupling for dexterous tactile e-skin

Hydrogels are promising materials for electronic skins and devices, though it is challenging to mimic the composition and architectural features of human skin. Here the authors use a sandpaper templating strategy for a gelatin based hydrogel electronic skin.

Yidan Chen, Shu Wang & Lingyi Lan

Article
26 May 2026 | Open Access
Absolute quantification of enantiomeric purity of sorted carbon nanotubes by correlating hyperspectral fluorescence microscopy with ensemble chiroptical spectroscopy

Accurately measuring the chirality of carbon nanotubes is a challenge in the absence of pure reference samples. Here, the authors combine hyperspectral imaging and chiroptical spectroscopy to quantify enantiomeric purity without having to rely on such standards.

Miguel Ángel López Carrillo, Filip Desmet & Dmitry I. Levshov

Article
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Transport of enzymatic activity across liquid-liquid interfaces using dynamic assemblies of magnetic particles via field-modulated interactions

Biological systems form structures across interfaces to perform functions, serving as inspiration for synthetic replicas. Here, the authors demonstrate that dynamic magnetic assemblies can transport enzymatic activity across liquid-liquid interfaces and trigger reactions.

Shilu Zhu, Shuwei Shen & Ronald X. Xu

Article
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Monolithically integrated photon-mapping infrared imager

The study presents a self-powered, monolithically integrated infrared imager that converts invisible signals into visible light. Its flexible, lightweight design enables simple, large-area, high-quality imaging.

Xingwei Han, Jun Wang & Weida Hu

Article
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Topology-dependent node dynamics under mechanical manipulation in moiré ferroelectrics

Topology governs how individual ferroelectric nodes in moiré WSe_2 respond to local mechanical perturbations: symmetric nodes remain robust, whereas non-ideal nodes can be displaced or fractured, revealing a direct link between topology and dynamics.

Sang Hwa Park, Nicolas Leconte & Sang Mo Yang

Article
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Directing intermediate phase crystallographic orientation promotes carbon-based $CsPbI_3$ perovskite solar cells to beyond 20% efficiency

Inorganic cesium lead iodide perovskites promise stable solar cells but are limited by slow conversion from a templating phase. Li et al. tuned crystal orientation using surface-bound lead-complexing groups to speed conversion and achieve efficient, durable devices.

Gaofeng Li, Jieke Tan & Haining Chen

Article
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Switchable synthesis of aldehydes and alcohols by hydroformylation with ligand-modified Rh single-atom catalyst

Selective catalysis is vital for greener chemical production, but switching products in one system is difficult. Herein a phosphorus ligand tunes single rhodium atoms on ceria to switch alkene hydroformylation between alcohols and aldehydes.

Bowen Qiu, Shujuan Liu & Feng Shi

Article
26 May 2026 | Open Access
Super-robust and sustainable bamboo structural material enabled by bonding network reconstruction

Bamboo can be processed into high performance structural material if its mechanical strength and homogeneity are enhanced. Here the authors report a strategy to process natural bamboo into a lightweight, robust, and durable structural material with high strengths in longitudinal and transversal directions through bonding network reconstruction.

Tao Du, Jiali Cheng & Xiao Xiao

Article
26 May 2026 | Open Access
Strain-localized luminescent e-skin for high-resolution pressure mapping and visual force feedback

Electronic skin shows strong potential for tactile sensing; however, designing systems that minimize crosstalk while maintaining conformity to dynamic surfaces remains a significant challenge. Here the authors report a soft mechano-electroluminescent system used for high-resolution pressure mapping.

Zixiong Wu, Shuwen Chen & Chwee Teck Lim

Article
26 May 2026 | Open Access
Topological structure optimization of B,N-doped nanographenes for deep-blue emitters

Deep-blue emitting materials are essential for OLEDs. Here, the authors show how molecular topology in B,N-doped nanographenes controls conformation and excited-state properties, enabling efficient, narrowband deep-blue electroluminescence.

Xiaosong Cao, Xingyu Huang & Chuluo Yang

Article
26 May 2026 | Open Access
Self-charged polar nematic monopoles and hybrid topological states: intertwining and domain integration

The authors find self-assembled polar topological networks in an emerging class of ferroelectric fluid, enabling large-scale domain engineering and controllable chiral order beyond solid-state ferroelectrics.

Yu Zou, Jidan Yang & Satoshi Aya

Article
26 May 2026 | Open Access
Robust flat-magnetoresistivity in $D0_3$-Fe_3Ga driven by chiral anomaly

While there has been extensive theoretical analysis of the 3D nodal flat-band topological semimetals, experimental realization has proved challenging. Here, Wang, Li, Zhao, Wen, and coauthors find a robust flat magnetoresistance in $D0_3$-Fe_3Ga, which, combined with DFT calculations and Hall measurements, provide strong evidence that $D0_3$-Fe_3Ga is a 3D nodal flat-band ferromagnet.

Ruoqi Wang, Xinyang Li & Jinlan Wang

Article
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Experimental asymmetric relativistic zero-knowledge proofs with unconditional security

Zero-knowledge proofs can protect privacy online, but almost all current methods are vulnerable to quantum attacks. Here, the authors report an efficient relativistic protocol and experiment that resists quantum attacks and greatly reduces runtime, randomness cost and communication rounds.

Chen-Xun Weng, Ming-Yang Li & Zeng-Bing Chen

Article
26 May 2026 | Open Access
Experimental demonstration of corrugated nanolaminate films as reflective light sails

Laser-driven light sails capable of reaching relativistic velocities in space have been proposed a century ago, but their experimental realization remains challenging. Here, the authors report the fabrication of flexible corrugated nanolaminate sails based on alumina and molybdenum disulfide, showing promising mass, optical and mechanical characteristics.

Matthew F. Campbell, Pawan Kumar & Deep Jariwala

Article
26 May 2026 | Open Access
Quantum beats of exciton-polarons in $CsPbI_3$ perovskite nanocrystals

Trifonov et al. employ transient two-pulse photon echo to reveal a fully coherent regime in CsPbI3 perovskite nanocrystals where the quantum beats between different exciton polarons are observed. It is also possible to tune the strengths of optical transitions between exciton-polaron states and their lifetimes.

Artur V. Trifonov, Mikhail O. Nestoklon & Ilya A. Akimov

Article
26 May 2026 | Open Access
Activity-guided substructure prioritization accelerates discovery of gut microbiota-derived immune-regulating metabolites

Gut microbiome influence host physiology through bioactive molecules. Here, the authors develop an activity-guided substructure discovery framework and identify immune-regulating metabolites derived from previously undercharacterized microbiome-mediated reactions.

Haoduo Zhao, Liang Chi & Kun Lu

Article
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A scalable and generic framework for city-wide traffic prediction with large language model

The work presents a large language model-based framework for short-term city-wide traffic prediction across multiple transport modes and scenarios, demonstrating scalability, generality, and effective performance on diverse real-world datasets.

Jinlei Zhang, Congwang Deng & Ziyou Gao

Article
26 May 2026 | Open Access
Multi-functional photonic crystals of modular nanosheets

Photonic crystals based on colloidal nanosheets can offer a versatile platform for structural colors. Here, the authors developed a modular strategy to synthesize functional hybrid nanosheets and constructed multi-functional photonic crystals with tunable properties via self-assembly.

Seiya Yui, Takumi Mihara & Koki Sano

Article
26 May 2026 | Open Access
Survival of the metallic state in a single-hole multiband *p*-orbital molecular system

The authors find that metallicity persists in Yb_2CsC_{60}, a single-hole multiorbital correlated *p*-electron system. They suggest that Hund's exchange reduces the impact of correlations away from half-filling, similar to d-orbital solids.

Keisuke Matsui, Ryan A. Klein & Kosmas Prassides

Article
26 May 2026 | Open Access
Ion-triggered reconfigurable hydrogels with salt-enhanced mechanical and swelling properties via network topological adaptation

Hydrogels have potential for applications in a range of environments, but tend to be unstable in high-saline conditions. Here, the authors report the development of a double-network hydrogel that strengthens with swelling in brine, due to the behavior of zwitterionic ion pairs.

Lingling Ren, Guoxuan Ma & Liyuan Zhang

Article
26 May 2026 | Open Access
Unconditionally teleported quantum gates between remote solid-state qubit registers

In this paper, an unconditionally teleported CNOT gate is realized between distant diamond NV-center qubit registers, using real-time feedforward and no post-selection. The result strengthens the case for modular architectures as a scalable route to distributed quantum computing.

Mariagrazia Iuliano, Nicolas Demetriou & Ronald Hanson

Article
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High energy triplet-state manipulation via temperature-responsive twisted hetero-annulation systems

Control of excited state transitions is important for a range of applications, but can be challenging. Here, the authors report the tailoring of size, geometry and electronic properties of conjugated systems to control high-energy and lowest-energy triplet-mediated pathways.

Guigui Ye, Yan Gao & Zhen Li

Article
25 May 2026 | Open Access
Monolithic integration of p- and n-type doped 2D WSe_2 for wafer-scale complementary logic circuits

The scarcity of effective doping strategies has so far limited the development of scalable complementary electronic circuits based on 2D semiconductors. Here, the authors report the fabrication of wafer-scale homogeneous top-gated complementary inverter arrays and logic circuits based on p-type and n-type doped 2D WSe_2 semiconducting channels.

Yan Hu, Shicheng Zeng & Wenzhong Bao

Article
25 May 2026 | Open Access
Elasticity-gated thermal plasticity via superheating-mediated nucleation and growth in polymer networks

It is useful to be able to determine the changes a material has undergone, but this is challenging in synthetic systems. Here, the authors report the development of a hydrogel materials conditioned by swelling, allowing determination of exposure to heat and salt by nucleation changes.

Guye Wei, Jiageng Pan & Liang Gao

Article
25 May 2026 | Open Access
Excited-state intramolecular proton transfer luminogens regulated by competing dynamic covalent bonds and hydrogen bonds

It is desirable, but challenging, to develop methods to control excited state intramolecular proton transfer. Here, the authors report the use of competing dynamic covalent bonds and non-covalent hydrogen bonds for control over such luminogens.

Fa Zhong, Hebo Ye & Lei You

Article
25 May 2026 | Open Access
Photocatalytic reductive carboxylation of unactivated hydrazones with CO_2

Catalytic methods for the reductive carboxylation of carbonyl derivatives with CO2 remain underexplored and predominantly limited to carboxylation of activated carbonyl derivatives, which rely on the generation of stabilized organometallic intermediates or carbanions to react with CO2. In this study, the authors report a reductive carboxylation of unactivated hydrazones with CO2 via visible-light photocatalysis.

Guang-Mei Cao, Li-Li Liao & Da-Gang Yu

Article
25 May 2026 | Open Access
Dynamics of dislocation formations and their impacts on exsolution in Ru-doped perovskite oxide

Using in situ Bragg coherent X-ray imaging and TEM analyses, the authors show Ru-doped perovskite exsolution occurs selectively at mixed dislocations that propagate from particle interiors as mobile vehicles, dynamically transporting Ru to surfaces.

Sungwook Choi, Younghwan Lim & Hyunjung Kim

Article
25 May 2026 | Open Access
Deprotonation suppressing via competitive proton transfer control for efficient perovskite solar cells

Formamidine-based perovskite solar cells promise high efficiency, but additive-induced deprotonation disrupts precursor stability and device performance. Dong et al. use a hydrolyzing ester additive to regulate proton transfer, stabilizing the precursor and achieve efficient, durable devices.

Hang Dong, Jinsong Qu & Chunfu Zhang

Article
25 May 2026 | Open Access
Ultra-broadband wireless rectification and frequency mixing via the nonlinear Hall effect in $TaIrTe_4$

Ultrabroadband rectification (19 MHz to 2.88 THz) and frequency mixing (0.1–40 GHz) are demonstrated in TaIrTe4 devices without any electrical bias or magnetic field, enabled by the nonlinear Hall effect at room temperature.

Fanrui Hu, Jiayu Lei & Hyunsoo Yang

Article
25 May 2026 | Open Access
De novo design of DNA origami with a generative diffusion model

AI-based inverse design of DNA origami has been limited by the scarcity of large, standardised datasets. Here, the authors present a diffusion-based design framework trained on simulated equilibrium conformations, highlighting the promise of generative AI models empowered by physical simulation for de novo design of DNA origami.

Chien Truong-Quoc, Kyoungchul Jeon & Do-Nyun Kim

Article
25 May 2026 | Open Access
Upcycling spent layered oxides into high-capacity Li-rich materials for next-generation lithium-ion batteries

Direct recycling of spent lithium-ion batteries is a promising and essential approach to address challenges related to energy security and resource sustainability. Herein, authors report an upcycling strategy that reconstructs degraded ternary layered oxide cathode materials into Li-rich oxides. The strategy is scaled to kilogram-level production and enables an energy density of 377 Wh kg^{-1} in a 14 Ah pouch cell.

Nengzhan Zheng, Yanfei Zhu & Guangmin Zhou

Article
25 May 2026 | Open Access
Cold sintering of hybrid copper-iodides in transparent ceramics using dolomitization-inspired densification

Hybrid copper iodides are promising, low-toxicity light emitters, but they are sensitive to heat and moisture. Here, the authors develop a low-temperature ceramic sintering process in which these materials are embedded in protective, transparent SrF_2 matrix to enable stable lighting and X-ray imaging.

Yu Ren, Fu-zhi Dai & Wan Jiang

Article
25 May 2026 | Open Access
Unraveling the dynamics of multiple excited states in a single-molecule transistor

Quantum transport through a single molecule is governed by the formation of short-lived excited states, yet probing these processes remains challenging. Zhang et al. track the dynamics of multiple excited states in a single-molecule radical transistor using nanosecond differential conductance spectroscopy.

Hao Zhang, Lijue Chen & Wenjing Hong

Article
25 May 2026 | Open Access
Hemadyne: accordion-inspired perfusion for microphysiological systems

The physiological relevance and reproducibility of microphysiological systems is currently limited by perfusion systems. Here the authors engineer Hemadyne, an accordion music-inspired pump that mimics human blood flow, and apply it to study how aging-related flow waveforms impact vascular health.

Ankit Kumar, Shivanand Pattanshetti & Abhishek Jain

Article
25 May 2026 | Open Access
Evolution of intragranular pores in potassium niobate ceramics during sintering

This study achieves high-density potassium niobate ceramics via hot-pressing. It identifies a unique intragranular pore-evolution mechanism driven by lattice diffusion, revealing how these pores dictate the material's chemical stability.

Xian-Xian Cai, Zhaonian Zhou & Ke Wang

Article
25 May 2026 | Open Access
Mitochondrial flagella-like extensions (MitoFLARE) dysfunction triggers STING-mediated immune dysregulation in sepsis

Sepsis triggers mitochondria to form flagella-like extensions that enable long-distance communication. As inflammation worsens, these structures rupture, releasing mitochondrial DNA and activating inflammatory pathways that drive immune dysfunction and organ failure.

Weilong Hong, Ruiyan Ma & Chenyang Duan

Article
25 May 2026 | Open Access
Measuring multi-site pulse transit time with an AI-enabled mmWave radar

Researchers built a single radar system that measures pulse transit time at multiple body sites without touching the skin. This could support long-term at-home monitoring of cardiovascular health and estimation of diastolic blood pressure.

Jiangyifei Zhu, Kuang Yuan & Swarun Kumar

Article
25 May 2026 | Open Access
Fermi-surface diagnosis for topological superconductivity with *s*-wave-like pairing symmetries

The authors derive formulas for topological invariants in time-reversal symmetric spinful superconductors invariant under all symmetry operations for a given space group. The formulas require only the sign of the intra-band pairing and sign of the Fermi velocity at several points on the Fermi surface.

Zhongyi Zhang, Ken Shiozaki & Seishiro Ono

Article
24 May 2026 | Open Access
Solar-driven peroxyacid group activation enables > 500 h stable hydroxyl-radical defluorination of industrial perfluorophenol wastewater

A carboxyl-functionalized photocatalyst generates hydroxyl radicals via a catalytic peroxyacid cycle, enabling complete defluorination of industrial-strength perfluorophenol without external oxidants and with >500 h stability under sunlight.

Yunning Chen, Qixin Zhou & Yongfa Zhu

Article
23 May 2026 | Open Access
Realization of a chiral photonic-crystal cavity with broken time-reversal symmetry

Researchers realized the first truly chiral terahertz cavity with time-reversal-symmetry broken vacuum fields, with near-unity ellipticity at 0.66 THz and Q>50 under a 0.3 T field, offering a robust platform for chiral light–matter interactions.

Kiran M. Kulkarni, Hongjing Xu & Junichiro Kono

Article
23 May 2026 | Open Access
One-dimensional $CsPbBr_3$ superlattices with polarized and amplified spontaneous circularly polarized emissions

Nanocrystal superlattices typically occur in two- and three-dimensional configurations, constrained to the micrometer scale and with limited size tunability. Here, the authors assemble CsPbBr3 nanoplatelets into chiroptically active 1D helical superlattices with mm lengths and μm widths.

Baowei Zhang, Kexin Chen & Siyu Lu

Article
23 May 2026 | Open Access
Trainable neuromorphic spintronic hardware Via analog finite-difference gradient methods

Spintronic in-hardware training has relied on software-based gradient calculations or unsupervised methods, leading to substantial computational overhead. Pereira et al. propose an MTJ-based analog neuron and hardware architecture that enables on-chip neuromorphic training without digital models, achieving high classification accuracy.

Catarina Pereira, Alex Jenkins & Davi Rodrigues

Article
23 May 2026 | Open Access
A polymer-coated nanowire sponge–based contact electrocatalytic system for simultaneous disinfection and removal of multiple micropollutants

A polymer-coated nanowire sponge utilizes mechanical energy to produce reactive oxygen species, enabling rapid disinfection and removal of diverse pollutants from water without added chemicals or rare metals.

Geng-Sheng Lin, Arshad Khan & Zhaohui Tong

Article
22 May 2026 | Open Access
Anomalous quantized nonlinear soliton pumping

Nonlinear soliton pumping has recently been observed and understood as the flow of instantaneous Wannier functions. Here, authors find an anomalous nonlinear soliton pump that differs from the linear Chern numbers, arising from soliton transitions between Wannier functions via intersite solitons.

Yu-Liang Tao, Jiong-Hao Wang & Yong Xu

Article
22 May 2026 | Open Access
Angle-based fluorescence thermometry with high sensitivity and high resolution

A plasmonic grating-based thermometer translates temperature into fluorescence emission angle shifts. This non-contact method achieves 0.01 °C resolution and effectively isolates thermal signals from environmental interferences.

Xuanzheng Zhou, Kang Xu & Min Wang

Article
22 May 2026 | Open Access
Hydrazine-mediated carbonyl–alkyne/allene reductive olefination

The authors report a hydrazine-mediated carbonyl–alkyne reductive olefination, offering a minimalist approach to structurally complex cycloolefins.

Linjun Qi, Wencan Wang & Xiaofeng Tong

Article
22 May 2026 | Open Access
Dual-domain metamaterials co-integrated with a compact ultrasonic transducer for highly directional audio generation

Acoustic and elastic metamaterials enable unprecedented wave control but rarely reach real-world device applications. Here, authors co-integrate dual-domain metamaterials with a piezoelectric ultrasonic transducer, delivering directional audio over 500 Hz-10 kHz in a compact form factor.

Woongji Kim, Beomseok Oh & Junsuk Rho

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Nature Communications (*Nat Commun*) | ISSN 2041-1723 (online)

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Featured

Article
29 May 2026 | Open Access

Grayscale projection two-photon lithography using sub-diffraction motifs for ultrafast and precise nanoscale 3D printing

The ability to precisely tune light intensity within projected images can massively scale up sub-100 nm additive manufacturing. Kim and Saha show how optical diffraction can be leveraged to achieve this with a single pulse of femtosecond laser.

Harnjoo Kim & Sourabh K. Saha

Article
29 May 2026 | Open Access

Noisy quantum learning theory

Expected quantum advantages in learning unknown system properties usually rely on idealized scenarios. Here, the authors develop a computational complexity framework to rigorously describe situations in which a fault-tolerant quantum computer is available but its coupling to the system of interest is noisy, showing how retaining exponential advantage is nontrivial - but possible.

Jordan Cotler, Weiyuan Gong & Ishaan Kannan

Article
29 May 2026 | Open Access

Directed trilithiation enables entropically stabilized heavy-atom-centered triangulenes

Embedding heavy main-group elements at the core of rigid π-conjugated frameworks has long been recognized as an ideal strategy for enhanced stability yet synthetic realization has remained elusive. Here the authors use a directed, regioselective trilithiation strategy for controlled incorporation of heavy elements into triangulene frameworks.

Hajime Gotoh, Soichiro Nakatsuka & Takuji Hatakeyama

Article
29 May 2026 | Open Access

Amplified friction via a cooperative entanglement domains and steric hindrance for damping hydrogels

Damping hydrogels have potential in protection from impact and vibration, but combining this performance with desirable mechanical properties is challenging. Here, the authors report the development of hydrogels with entangled domains for resistance to chain sliding, giving favourable performance.

Zimo Pang, Sijia Li & Hezhou Liu

Article
29 May 2026 | Open Access

Sterically-extended asymmetric conjugated hole-selective layer for perovskite/silicon tandem solar cells

Carbazole-based monolayers aid perovskite–silicon tandem solar cells yet preventing aggregation while maintaining charge transport on textured silicon is challenging. Yan et al. create sterically extended asymmetric carbazole molecules that form continuous three-dimensional pathways, improving efficiency and stability.

Tingxia Yan, Chenxu He & Xinhua Ouyang

Article
29 May 2026 | Open Access

Ultrahigh piezoelectric performances in soft lead zirconate titanate/polydimethylsiloxane composites by ethanol-assisted freeze casting

The authors report ethanol-assisted freeze casting of flexible PZT/PDMS composites with enhanced piezoelectric performance, improved structural uniformity, and excellent mechanical deformability, underscoring their potential for sensing technologies.

Yao Xiao, Lei Yang & Yang Shen

Article
29 May 2026 | Open Access

Programmable electric hysteresis in graphite/MoS_2 heterojunctions through twisting

Authors find that graphite/MoS_2 van der Waals heterojunctions exhibit twist-angle dependent electrical hysteresis, with the memory window sharply decreasing near 30°. Their superlubric interface enables rapid, energy-efficient twisting and memory tuning.

Zhaokuan Yu, Juntai Wu & Ming Ma

Article
28 May 2026 | Open Access

Photonic-integrated quantum sensor array for microscale magnetic localisation

Arrays of NV centres operating in parallel promise advantages in resolving spatio-temporal dynamics. Here, the authors report an array of eight localised NV-ensemble sensors integrated in silicon nitride photonic circuits with simultaneous readout and demonstrate applications to magnetic localisation and position tracking.

Hao-Cheng Weng, John G. Rarity & Joe A. Smith

Article
28 May 2026 | Open Access

Bridging quantum mechanics to liquid properties via a universal organic force field

The authors present ByteFF-Pol, a force field trained solely on quantum data to accurately predict liquid and electrolyte properties. It bridges the gap between microscopic calculations and materials design without experimental calibration.

Tianze Zheng, Xingyuan Xu & Wen Yan

Article
28 May 2026 | Open Access

Direct imaging of magnetotransport at graphene-metal interfaces with a single-spin quantum sensor

Electrons subject to a magnetic field experience a Lorentz force, which can substantially alter their transport properties and give rise to complex magneto-transport phenomena. Here, Ding et al succeed in imaging Lorentz force induced deflection of current flow in a graphene/metal hybrid device using scanning nitrogen-vacancy (NV) magnetometry.

Chaoxin Ding, Marius L. Palm & Christian L. Degen

Article
28 May 2026 | Open Access

Revealing ultrafast proton-transfer-mediated autoionization as a source of low-energy electrons in hydrogen-bonded systems

Here, the authors tracked ultrafast proton migration and hydrogen back-transfer in photoionized water dimers. These dynamics trigger fast autoionization that emits low-energy electrons, key agents in DNA damage, outpacing intermolecular Coulombic decay.

Wael Iskandar, Yi-Siang Wang & Thorsten Weber

Article
28 May 2026 | Open Access

A persistent germylyne radical enabling reversible σ-dimerization and diverse bond activation

The reversible σ-dimerization of radicals is a fundamental process in bond formation and cleavage, yet is challenging to achieve with an isolable heavy carbyne analog. Herein, the authors report the synthesis and characterization of an isolable germylyne radical that demonstrates ambient stability while undergoing reversible σ-dimerization via a Ge–Ge single bond.

Xingyu Yang, Meirong Song & Xinping Wang

Article
28 May 2026 | Open Access

Inverse-designed silicon nitride nanophotonics

This work presents a broad overview of inverse-designed nanophotonic components in silicon nitride, including wavelength- and mode-division multiplexers, dispersion engineered mirrors and microresonators for nonlinear optics and quantum photonics.

Toby Bi, Shuangyou Zhang & Pascal Del'Haye

Article
28 May 2026 | Open Access

In situ ptychographic nanotomography captures activation, mobility, and deactivation of supported catalysts

Understanding and preventing the loss of active surface area in supported catalysts due to transport and sintering processes remains an industrial-scale challenge. Here, using in situ ptychographic nanotomography, the authors track the formation, mobility and aggregation of 100,000 s of catalyst nanoparticles in a supported catalyst under operating conditions.

Arik Beck, Mirko Holler & Johannes Ihli

Article
28 May 2026 | Open Access

Coherent quantum control of nitrogen vacancy spin with nanoscale magnets

Microwave control of NV center spins in diamond is limited by power consumption and the degree of localization. Here, the authors report localized coherent quantum control of NV centers using surface acoustic wave-driven nanomagnets, enabling high-contrast Rabi oscillations and scalable, potentially energy-efficient spin manipulation.

Md Fahim F. Chowdhury, Adi Jung & Jayasimha Atulasimha

Article
28 May 2026 | Open Access

Breaking the membrane heredity paradox through de novo protocell formation

A central paradigm in biology is that cellular membranes descend from a common ancestral membrane, and it is currently unclear whether lipid membranes can arise from membrane-less precursors. In this study, the authors demonstrate the de novo generation of lipid bilayers in the absence of any pre-existing membranes, membrane-bound proteins, or lipid nanostructure templates.

Satyam Khanal, Alessandro Fracassi & Neal K. Devaraj

Article
28 May 2026 | Open Access

An artefact-resilient wide bandwidth bidirectional graphene neural interface

Recording and modulating neural activity is critical for next-generation bidirectional neural interfaces. Here the authors present a bidirectional neural interface based on graphene transistors, to artifact-resilient and full frequency bandwidth

Michał Prokop, Martín Esparza-Iaizzo & Jose A. Garrido

Article
28 May 2026 | Open Access

Volatile self-selective memristive neuron for millisecond-latency neuromorphic object detection at the edge

Real-time object detection in edge applications is constrained by power and latency. Zhang et al. report a self-selective memristor with high selection ratio and fast decay speed to realize high-performance artificial neurons. High recognition accuracy is validated for drone object detection using such a neuron array.

Zhejia Zhang, Jiahua Xu & Yishu Zhang

Article
28 May 2026 | Open Access

Superconductivity from quasiparticle pairing of intervalley coherent state in rhombohedral trilayer graphene

1 The authors theoretically study superconductivity in rhombohedral tri-layer graphene. They propose 2 that the superconducting phase arises from the pairing of quasiparticles of the adjacent inter-valley 3 coherent state, instead of pairing between bare electrons.

Chun Wang Chau, Shuai A. Chen & K. T. Law

Article
28 May 2026 | Open Access

Bulk spinodal-architected compositionally complex alloy with enhanced energy absorption across a wide temperature range

Here, researchers fabricated bulk architected alloys via electrochemical dealloying of a ML-identified compositionally complex spinodal alloy, achieving high energy absorption across a wide temperature range via a seven-order hierarchy.

Hao Gong, Yushan Geng & Yong Yang

Article
28 May 2026 | Open Access

Invariance under quantum permutations rules out parastatistics

The current understanding of why observed particles are only fermionic or bosonic under particle exchange is still incomplete. Here, the authors propose a modification of permutation invariance which encompasses quantum information invariance and quantum permutations, and show that, if one imposes such criteria, parastatistics is ruled out and only bosonic and fermionic statistics are left.

Manuel Mekonnen, Thomas D. Galley & Markus P. Müller

Article
28 May 2026 | Open Access

Diverse configurations of binary asteroids explained by multi-generation satellites

Binary asteroids are common, yet their diverse configurations remain mysterious. Here, the authors show how repeated mass shedding and satellite migration drive this diversity, explaining complex forms like contact-binary satellites.

Wen-Yue Dai, Bin Cheng & Junfeng Li

Article
28 May 2026 | Open Access

Homeostatic dendritic neuron based on co-integrated volatile and non-volatile memristors for neuromorphic processing

Current neuromorphic systems are constrained in handling temporally complex computation. Zhang et al. present a fully memristor-based neuron-dendritic system that endows multi-timescale signal processing capability, delivering accurate and energy-efficient computational performance.

Licheng Zhang, Teng Zhang & Yuchao Yang

Article
28 May 2026 | Open Access

Sustainable supercritical-mechanochemical process

The authors develop a supercritical mechanochemical process which converts metal oxides to MOFs, enabling rapid, low-cost kilogram-scale production under mild conditions for sustainable manufacturing.

Hao Zhang, Wen Ren & Huijun Tan

Article
28 May 2026 | Open Access

Simulating electron transfer on noisy quantum computers

The authors present a framework for simulating open quantum systems that turns hardware noise into a resource, and implement it on superconducting quantum computers. Going beyond spin-boson models, they capture vibronic electron-transfer dynamics central to many applications of chemistry.

Marvin Gajewski, Alejandro D. Somoza & Birger Horstmann

Article
28 May 2026 | Open Access

Direction-specific enhanced diffusion of CO_2 in chiral hexagonal boron nitride nanotubes

Near perfect direction-specific diffusion of CO_2 can be achieved in chiral hexagonal boron nitride nanotubes, exhibiting over 3 times faster diffusion than N_2. Hypothetical sheet membranes using aligned tubes project a CO_2/N_2 permselectivity of 170 and a CO_2 permeability that readily surpasses the Robeson upper bound.

Manh-Thuong Nguyen, David J. Heldebrant & Zhijie Xu

Article
27 May 2026 | Open Access

Water engineering via surfactant coacervates enables efficient and robust solar hydrogen evolution

Water structure plays a critical role in solar hydrogen production but has rarely been tuned to improve reactivity. Here, the authors report that surfactant-based coacervates create more active water environments that markedly enhance catalytic hydrogen generation.

Xiaojuan Bai, Jiahong Liu & Jianbin Huang

Article
27 May 2026 | Open Access

Atomic-scale revelation of in situ reverse regulation from particles to clusters in the Ni/La-CeO_x catalyst

Metal clusters can make efficient catalysts but often grow unstable at high heat. Here, the authors show how nickel particles can disperse into stable clusters, improving hydrogen production and durability.

Xuan Meng, Lu-Yao Zhang & Chun-Hua Yan

Article
27 May 2026 | Open Access

Functional modules for enhanced amorphous composite halide solid electrolytes for low-temperature all-solid-state lithium batteries

Designing improved halide solid electrolytes holds the key to the success of all-solid-state batteries. Here, authors present the design of SSEs through functional modules, introducing LaCl3, which possesses a UCl3 structure, as well as low-cost and low-density AlF3, to enable low-temperature application and improve moisture and high-voltage stability in halide-based solid-state battery systems.

Yanlong Wu, Xinmiao Wang & Jiantao Wang

Article
27 May 2026 | Open Access

Enhanced volumetric additive manufacturing via Reversible Addition-Fragmentation Chain Transfer (RAFT) polymerization

Computed Axial Lithography is a volumetric 3D-printing method which typically uses exothermic free radical polymerisation, leading to auto-acceleration, thermal gradients and non-uniform printed objects. Here the authors used RAFT polymerisation to overcome this problem, achieving uniform samples with high resolutions.

Eduards Krumins, Yaxuan Sun & Derek J. Irvine

Article
27 May 2026 | Open Access

Correlating solvation shell dynamics and ion transport in highly ordered nanoporous polymers

ShortSummaryA multipronged experimental and MD simulation-based approach resolves a single-contact exchange mechanism for ion transport in a structurally homogeneous nanoconfined anion exchange membrane. The mechanism offers new design principles.

Ranadeb Ball, Christopher W. Johnson & Jessica M. Anna

Article
27 May 2026 | Open Access

Ultra-high density perovskite nanowire array memristor-based multi-layer perceptron

Poddar et al. report perovskite nanowire array-based memristors. A thin ITO layer is introduced as a semi-permeable barrier between electrode and perovskite for controllable analog switching. A physical multi-layer perceptron based on a 64×64 crossbar array enables the analysation of zebrafish strike patterns.

Swapnadeep Poddar, Biswadeep Khan & Zhiyong Fan

Article
27 May 2026 | Open Access

One-dimensional inorganic ionic polymerization for elastic minerals

Through a one-dimensional inorganic ionic polymerization strategy, researchers have successfully obtained elastic minerals that combine high hardness with elastomer-like flexibility, which hold promise for high-strength intelligent strain sensors.

Yongjin Du, Zeyu Gong & Junbo Gong

Article
27 May 2026 | Open Access

Altermagnetic type-II multiferroics with Néel-order-locked electric polarization

There are several examples of ferroelectric altermagnetic materials; however, it remains an active question as to whether an electric polarization can be induced by altermagnetic spin ordering. Here, Guo, Xu and coauthors demonstrate a link between the electric polarization vector and the altermagnetic Néel order parameter, which unambiguously realizes type-II multiferroicity.

Wen-Ti Guo, Junqi Xu & Huaiqiang Wang

Article
27 May 2026 | Open Access

Bio-inspired relay catalysis for aqueous redox flow batteries

Aqueous redox flow batteries are promising for large-scale energy storage, but many suffer from sluggish kinetics. Here, authors report a relay catalysis strategy to break the trade-off between overpotential and catalytic rate in sulfur- and organic-based flow cells.

Jiafeng Lei, Yaqin Zhang & Yi-Chun Lu

Article
27 May 2026 | Open Access

Selective lignin conversion via flow photocatalysis for vanillin and bioplasticizers production

Lignin valorization remains a roadblock in the development of green biorefineries. Here the authors demonstrate a scalable photocatalytic flow reactor for lignin deconstruction that operates at ambient conditions, along with a downstream process that yields commercially viable products at gram scale

Xavier Marset, Salvador Montilla-Verdú & Néstor Guijarro

Article
27 May 2026 | Open Access

Protonation and magnesium ions shape the transition state diversity of phosphoanhydride hydrolysis in water

This study shows how pyrophosphate hydrolysis in water proceeds through multiple pathways shaped by protonation and magnesium ions, with magnesium mainly acting by shifting protonation equilibria rather than directly catalysing the reaction.

Adrián García-Martínez, Miguel de la Puente & Iñaki Tuñón

Article
27 May 2026 | Open Access

4D metallic metamaterials for bone implants via biodegradation

Here the authors integrate metamaterial design with controlled biodegradation to achieve programmable 4D shape transformation of metallic scaffolds. They show that this feature delivers synergistic mechanical stimuli and bioactive ions to enhance in vivo bone regeneration.

Yu Qin, Zehao Jing & Weishi Li

Article
27 May 2026 | Open Access

Monitoring in vivo transcription with synthetic serum markers

Typically, transcription in vivo is measured post-mortem or in biopsied tissue samples. Here, the authors show a method where transcript levels can be reported in living animals with synthetic serum markers and simple blood test.

Sho Watanabe, Sangsin Lee & Jerzy O. Szablowski

Article
27 May 2026 | Open Access

Tianwen-2 mission target asteroid (469219) Kamoʻoalewa probably develops an Itokawa-compositional but more space-weathered surface

The origin of asteroid (469219) Kamo'oalewa, target of China's Tianwen-2 mission, is debated. Here, the authors show that it probably originated from the Flora family and it resembles asteroid (25143) Itokawa-like composition but with a more space-weathered surface.

Pengfei Zhang, Guozheng Zhang & Yang Li

Article
27 May 2026 | Open Access

Expedient single-round selection of hyper-modified aptamer targeting insulin receptor from over-represented dually nucleobase-modified DNA libraries

The discovery of aptamers generally relies on laborious multiple-round selections with low success rate. Here, authors report the rapid, single-round selection of highly specific base-modified aptamers from overrepresented modified DNA libraries containing two different modified nucleotides.

Pablo Alberto Franco-Urquijo, Marek Ondruš & Michal Hocek

Article
27 May 2026 | Open Access

Explainable time-series forecasting with sampling-free SHAP for Transformers

Time-series forecasting is crucial for decision making in many domains. The authors propose SHAPformer, a method for accurate and explainable time-series forecasting, delivering explanations in less than a second. It is validated on synthetic data and used to gain insights into electrical load and electricity price data.

Matthias Hertel, Sebastian Pütz & Benjamin Schäfer

Article
27 May 2026 | Open Access

AFM imaging reveals the unreconstructed α-Al_2O_3(0001) surface to be inhomogeneous and rough

The unreconstructed α-Al_2O_3(0001) surface is widely assumed to be atomically flat. Here, the authors use noncontact-AFM to show that it is rough and laterally inhomogeneous, challenging structural models used for alumina surfaces across materials science.

Johanna I. Hütner-Reisch, Andrea Conti & Jan Balajka

Article
27 May 2026 | Open Access

Chemical bonding concepts emerge naturally from maximally entangled atomic orbitals

Chemical bonding explains how atoms bind together, but it remains hard to define in universal terms. Here, the authors use quantum entanglement to uncover and quantify bonds in complex systems beyond the standard Lewis paradigm.

Lexin Ding, Eduard Matito & Christian Schilling

Article
27 May 2026 | Open Access

Demonstration of efficient predictive surrogates for large-scale quantum processors

This study introduces provably efficient predictive surrogates that emulate quantum processors, enabling substantial reductions in quantum resource overhead for VQE and quantum simulation tasks, and demonstrate it on a 42-qubit superconducting device.

Wei-You Liao, Yuxuan Du & He-Liang Huang

Article
27 May 2026 | Open Access

Giant topological magneto-optical effect in noncoplanar antiferromagnet

Certain antiferromagnetic spin structures possess a scalar spin chirality, which can act as an effective magnetic field, despite having vanishing magnetization. Here, Okamura, Hayashi and co-authors demonstrate that the all-in-all-out antiferromagnetic order in $CoNb_3S_6$ has a giant magneto-optical Kerr effect arising from spin chirality.

Y. Okamura, Y. Hayashi & Y. Takahashi

Article
26 May 2026 | Open Access

Electrically reconfigurable polarization control with double tri-layer black phosphorus heterostructures

Layered anisotropic 2D materials hold potential for the realization of compact polarization modulators. Here, the authors realize a Fabry-Perot cavity integrating two orthogonally stacked and independently gated black phosphorus trilayers, showing tunable polarization control and predicting electronic access to up to 86% of the Poincaré sphere.

Samuel K. W. Seah, Souvik Biswas & Harry A. Atwater

Article
26 May 2026 | Open Access

A self-powered spherical compound eye with 8 ns-motion response for source-constrained drones

This work demonstrates a self-powered, event-nature artificial spherical compound eye that achieved ultrafast and panoramic motion sensing under 0 V, particularly suitable for resource-limited drones and robotics.

Wei Ren, Xiaoming Zhao & Leilei Gu

Article
26 May 2026 | Open Access

Optimising DNA origami assembly by reducing off-target interactions

Off-target binding can result in kinetic traps reducing the efficiency of DNA origami assembly. Here, the authors develop a software tool to design scaffold & staples with chosen sequences to avoid unwanted molecular interactions, yielding stronger, more uniform nanostructures.

Ben Shirt-Ediss, Emanuela Torelli & Natalio Krasnogor

Article
26 May 2026 | Open Access

A general method for synthesizing heteropore covalent organic framework membranes to rapidly enrich uranyl ions

Heteropore covalent organic framework membranes have excellent uranium extraction capabilities, but their fabrication with well-defined hierarchical pores remains challenging. Here, the authors describe the pre-coating of covalent organic framework nanoparticles onto a nylon substrate as a general method for the preparation of heteropore covalent organic framework membranes.

Yue Zheng, Wanying Chen & Guangshan Zhu

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