

Physical sciences articles within *Nature Communications*

Featured

Article

20 June 2020 | Open Access

Solving the vibrational Schrödinger equation with artificial neural networks

Solving the full-dimensional vibrational Schrödinger equation remains challenging for polyatomic molecules. The authors present an efficient neural-network approach for accurate vibrational energy calculations for molecules with more than ten atoms.

H. Ren, Z. Gao, S. Wang, S. Li & M. J. Gill

Article

24 June 2020 | Open Access

Axion electrodynamics in a topologically trivial antiferromagnet

It is possible to realize axion electrodynamics in a material with an isotropic and linear magnetoelectric response. However, such a material has thus far evaded experimental realization. Here, Malina et al. succeed in creating such a linear isotropic magnetoelectric response in powdered Chernia.

Abhishek Mishra, Rishu Karanthy & Christian Eder

Article

20 June 2020 | Open Access

Direction-resolved nanoscale optical imaging with near-nanometer resolution by emerging infrared torsional force microscopy

Probing nanoscale light-matter interactions requires simultaneous access to optical anisotropy and subwavelength spatial resolution. Here, authors develop torsional force microscopy infrared imaging, enabling near-nanometer optical imaging and direction-resolved mapping of local optical responses.

Yinbin Gao, Sen T. Le & Min Ouyang

Article

20 June 2020 | Open Access

Overcoming chromium poisoning in solid oxide cells through multiscale perovskite engineering

Chromium poisoning and sluggish oxygen kinetics limit oxygen electrodes in reversible solid oxide cells. Here, the authors report a triple-barrier perovskite that suppresses Cr segregation, traps chromium, and tunes surface chemistry, enabling strong chromium tolerance and long-term stability.

Xin Li, Huihui Liu & Zhebin You

Article

20 June 2020 | Open Access

Modal contrast engineering in ultraviolet and visible metalenses enabled by material-selective hybridization

The authors present a material-selective hybrid metalens which produces high-efficiency performance in distinct spectral windows without geometric modification. The work establishes hybrid metasurfaces as a manufacturing-compatible alternative to bulk refractive optics.

Junhua Song, Youngun Jeon & Junxiao Shi

Article

20 June 2020 | Open Access

Cobaloxime-catalysed regio/divergent hydrogen atom transfer for alkenyl and allylic carbamoylation with branched alkenes

The authors report a regioselective hydrogen atom transfer process that enables divergent carbamoylation of branched alkenes. Through modulation of the electronic and steric properties of the ligands, this cobalt complex achieves precise discrimination between hydrogen atoms exhibiting minor differences in bond dissociation energies (BDEs), affording vinyl and allylic alkenes with predictable selectivity.

Ziyu Jiang, Jing-Ran Shan & Jianmin Zhao

Article

20 June 2020 | Open Access

Chiral chromophore engineered donor for constructing circularly polarized organic long-persistent luminescence exciplexes

Organic long-persistent luminescent materials with chirality are desirable but hard to obtain. Here, the authors report the development of such materials with exciplex emission as a result of a charge transfer process.

Xin Yan, Yanting Li & Wei Huang

Article

20 June 2020 | Open Access

Ambient pressure recovery of the structurally unconventional hydride $\text{YFe}_2\text{H}_{20}$

A hydrogen-rich material, $\text{YFe}_2\text{H}_{20}$, is synthesized at more than 60 GPa and remains metastable at ambient conditions for days. The combination of single crystal x-ray diffraction and ab initio structural search allows to determine its structure.

Matteo Casati, Lolo Torralba & Paul Loubeyre

Article

20 June 2020 | Open Access

Solvent-triggered reconfiguration of optical physical unclonable functions

Researchers report a reconfigurable optical anti-counterfeiting tag whose microscopic fingerprint can be rewritten on demand by a droplet of volatile solvent, enabling reversible security without heat, light, or special equipment.

Ji Hoon Kim, Jihye Kim & Won Ho Lee

Article

20 June 2020 | Open Access

Tetravalent organic cation-enabled dual interfacial regulation for durable aqueous zinc–iodine batteries

Interfacial instability limits aqueous zinc–iodine batteries. Here, the authors introduce a high-valent organic cation electrolyte that electrostatically engineers bipolar interfaces to suppress polysulfide shuttling and regulate Zn deposition, resulting in markedly improved cycling stability.

Doudou Feng, Yanchun Gu & Jijun Lu

Article

20 June 2020 | Open Access

N-Bordered Bylene Arches via Programmable Curved π -Extension

Curved molecular carbons have garnered interest for their distinct properties compared to planar analogues but are a synthetic challenge. Herein, the authors report the synthesis of arch-shaped N-bordered nanoribbons prepared via a programmable curved π -extension strategy.

Kui Chen, Zanyu Li & Zhaohui Wang

Article

20 June 2020 | Open Access

Hydroxyl chemistry regulation of cellulose biopolymers for aqueous zinc battery binders

Cellulose is an abundant and sustainable material, but its molecular chemistry remains underused in battery design. Here, authors tailor cellulose hydroxyl chemistry to produce multifunctional binders that stabilize aqueous Zinc battery electrodes and improve cycling stability and rate performance.

Ronghui Xu, Ningning Chen & Zhaohui Wang

Article

20 June 2020 | Open Access

Biomimetic ferroelectric semiconductor transistor enables neuronal multisensory integration

Applying the brain's multisensory integration is vital for artificial intelligence. Here, the authors have developed biomimetic ferroelectric semiconductor field-effect transistors to mimic the brain's audiovisual integration driven by hardware-native multi-physics coupling.

Shen Liu, Ligang Zhang & Ning He

Article

20 June 2020 | Open Access

Creation of a computational space with model-free metasurface neural network

Physical neural networks promise fast and energy-efficient computing but are difficult to train in complex environments. Here, the authors create a computational space that bears from electromagnetic interactions, enabling wave focusing, object recognition, and localization without digital models.

Mingfei Song, Chao Qian & Hongsheng Chen

Article

20 June 2020 | Open Access

Practical and divergent electrochemical access to thio-carbamoyl fluorides and N-trifluoromethyl amines from secondary amines

The authors report a practical and divergent electrochemical method for converting simple secondary amines into thio-carbamoyl fluorides and N-trifluoromethyl amines, proceeding under mild, open-air conditions without solvent drying, degassing, inert atmosphere, or stoichiometric silver reagents.

Felix T. Pulikottil, Daniel F. Cancho & Kevin Lam

Article

20 June 2020 | Open Access

Dynamic heterogeneity in the self-induced spin glass state of elemental neodymium

Dynamic heterogeneity relates to particular local length scales in glassy materials that persist over time. While well studied across a range of glassy materials, its presence in spin glasses remains unclear due to the requirement of nanoscale imaging. Here, using spin-polarized scanning tunnelling microscopy, Nagai et al. image dynamic heterogeneity in real space in a self-induced spin glass.

Lorenz Niggli, Julian H. Doh & Alexander A. Khajetoorian

Article

24 June 2020 | Open Access

An autonomous lab for data-driven homogeneous catalysis

The authors report Fast-Cat, a closed-loop autonomous catalytic platform that couples parallel miniaturized batch reactors for pressurized gas-liquid chemistry with a hierarchical, plate-constrained Bayesian optimization framework to find discrete (ligand identity) and continuous (process) variables.

J. A. Bennett, N. Chouli & M. Alchouse

Article

20 June 2020 | Open Access

Water-modulated conformational heterogeneity underlies multiple timescales of primary charge separation in photosystem II

Photosystem II converts sunlight into chemical energy via ultrafast charge separation. Here, the authors show that water molecules in protein channels drive the multi-microsecond electron transfer kinetics from multistep quantum/classical simulations.

Matteo Capone, Ally Benny & Isabella Dalbosco

Article

20 June 2020 | Open Access

Cooperative chelation for high-performance Perovskite light-emitting diodes

Molecular additives improve perovskite light-emitting devices, but single additives cannot passivate defects. The authors design a bidentate ligand, Li-6g, to use two cooperative additives to bind different planes, slowing growth and boosting efficiency, radiance, and stability.

Rui Li, Chunze Fan & Zhi-Kuang Yin

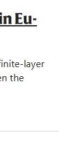
Article

24 June 2020 | Open Access

Observation of magnon polarons in the van der Waals itinerant ferromagnet Fe_3GeTe_2

Two-dimensional magnetic materials have magnetic properties that are sensitive to strain, implying a strong coupling between the magnetic and lattice degrees of freedom. Here, using terahertz scanning tunnelling spectroscopy (Li, Samul, and coauthors find the lattice signatures of magnon polarons in the two-dimensional ferromagnet, Fe_3GeTe_2 .

Qili Li, Namrata Bansal & Wulf Wulfschlegel



Article

19 June 2020 | Open Access

Isolation and reactivity of an alkyl-substituted germanium(II) radical anion

Low-valent main group radicals are difficult to isolate because they are highly unstable. Here, the authors report a stable germanium radical anion and reveal its structure, bonding and distinctive reactivity.

Chongting Yao, Yuesen Bi & Zhaoxian Dong

Article

19 June 2020 | Open Access

Entropy-driven order-to-disorder transition in perovskite anodes for high-performance solid oxide fuel cells

Carbon deposition and insufficient reactivity hinder the development of anodes in solid oxide fuel cells. Here, authors propose an entropy-induced order-to-disorder transition strategy to facilitate high-entropy anodes to attain improved catalytic activity and durable coking resistance.

Gaige Wang, Rongsheng Ren & Kening Sun

Article

19 June 2020 | Open Access

Koopman global linearization of contact dynamics for robot locomotion and manipulation enables elaborate control

Vicelike contact underpins the use of Koopman operators with sufficient accuracy to control inputs. This enables the convex Model Predictive Control of a legged robot, and the real-time control of a manipulator engaged in dynamic pushing.

C. O'Hall, J. Torres & H. H. Alaa

Article

19 June 2020 | Open Access

Electron-rich dianion vacancies boost diazenide intermediates for efficient chemical looping ammonia synthesis

Activating nitrogen under mild conditions remains a central challenge in ammonia synthesis, driving the need for electron-rich active sites that can facilitate N_2 activation using a programmable surface. Here, the authors create electron-rich dianion vacancies in a rare-earth carbide catalyst, providing a promising route to efficient and stable ammonia synthesis under mild conditions.

Jiaqi Wang, Bo Dai & Tian-Nan Ye

Article

19 June 2020 | Open Access

In situ grapheme-seq: spatial transcriptomics and chronic electrophysiological characterization of tissue microenvironments

Biological tissues exhibit coupled electrical activity and gene expression that are difficult to measure simultaneously. Here, authors introduce in situ grapheme sequencing, integrating electrophysiology with spatial transcriptomics to enable multimodal characterization of tissue microenvironments.

Janyong Lee, Wenbo Wang & Jia Lu

Article

19 June 2020 | Open Access

Controlled assembly of two-dimensional porphyrin heterostructures toward directed energy transfer and charge separation

Reproducing the structural control of natural organized supramolecular architectures in synthetic aqueous assemblies remains challenging. Here, we report a general seeded-growth strategy that enables precise, hierarchical assembly of two-dimensional porphyrin heterostructures in water.

Yihui Lei, Fangfang Zhang & Jia Tian

Article

19 June 2020 | Open Access

A light-driven multi-state heterojunction transistor for optoelectronic ternary logic circuits

Most optoelectronic circuits remain constrained by conventional binary logic. Here, Lee et al. report a light-driven multi-state transistor that converts optical inputs into ternary logic states, enabling reconfigurable logic and in-sensor image processing within a single device architecture.

Changrong Lee, Dongho Choi & Sung-Gap Im

Article

19 June 2020 | Open Access

Bi-directional reactant flux coupling in hollow hierarchical covalent organic framework enabling efficient uranium extraction from seawater

Photocatalytic uranium extraction can surpass intrinsic capacity limits of adsorption but is slow. Limitations in continuously flowing and ultra dilute seawater. Here the authors report a hollow hierarchical covalent organic framework microcavity reactor that decouples H_2O_2 generation from uranyl capture via bidirectional reactant flux coupling.

Jiahe Zhang, Xuesen Cao & Ning Wang

Article

19 June 2020 | Open Access

Enabling high-voltage aqueous dual-ion batteries capable of working at $-40\text{ }^\circ\text{C}$ in a low-concentration salt electrolyte

Graphene-based anion intercalation aqueous dual-ion batteries using TiO_2 are limited by the need for highly concentrated salt electrolytes. Here, the authors develop a dipole molecule-rich hydrogel electrolyte enabling high specific energy at $-40\text{ }^\circ\text{C}$.

Chuan Li, Xintao Ma & Cheng Zhi

Article

19 June 2020 | Open Access

AI-2D vertical metal-semiconductor field-effect transistor with sub-10 nm channel and contact lengths

The simultaneous downsizing of the channel length (L_{ch}) and contact length (L_c) remains an important challenge towards the industrialization of 2D transistors. Here, the authors report the realization of high-performance vertical metal-semiconductor field-effect transistors based on 2D MoS_2 channels with sub-10 nm L_{ch} and L_c .

Yi Zhang, Xianghui Jia & Lun Dai

Article

19 June 2020 | Open Access

Paramagnetically driven superconducting re-entrance in Eu-doped infinite layer nickelates

The authors observe magnetic field-induced re-entrant superconductivity in Eu-doped infinite layer nickelates thin films. They show that this behavior is the result of a delicate balance between the competing effects of the Eu^{2+} and Ni^{2+} ions.

Luisa Velasco, Lukas Korman & Jean-Marc Tillman

Article

19 June 2020 | Open Access

Engineered halohydrin dehalogenase mediates remote enantiocontrolled dehalogenative hydroxylation via an unconventional mechanism

Halohydrin dehalogenases are promiscuous biocatalysts that typically mediate the intramolecular dehalogenative cyclization of haloalcohols to form cyclic ethers, as well as the ring-opening of these O-heterocycles with various anionic nucleophiles. Here, the authors report that engineered variants of the halohydrin dehalogenase Hhdc, instead catalyze an intermolecular dehalogenative hydroxylation of haloalcohols with remote enantiocontrol.

Xiao Jin, Hai Xia Zhang & Nan-Wen Wan

Article

19 June 2020 | Open Access

Gradient-distributed metal-halide dynamic memristors for adaptive and robust voiceprint recognition

Voiceprint recognition is critical for biometric security, yet it remains susceptible to real-world acoustic disruption. Shen et al. report a gradient-distributed metal-halide memristor that exploits intrinsic adaptive dynamics to achieve robust and accurate voice recognition under noisy conditions.

Hu Shao, Janyu Ming & Wei Huang

Article

19 June 2020 | Open Access

Fully-connected microwave photonic multi-beamformer with fast beam-steering for broadband wireless communication

Researchers demonstrate a fully connected microwave photonic beamformer that enables broadband, agile, multi-beam steering with 60 ns switching, improving wireless signal gain and supporting high-quality 5G-6G communication.

Zhong Ni, Longjun Lu & Jing-Jing Zhou

Article

19 June 2020 | Open Access

Impact of the local valley splitting on the coherence of conveyor-belt spin shuttling in 2D Si/SiGe

Variations in valley splitting pose a major challenge for coherent electron spin transport in silicon quantum-dot arrays. Here, the authors report spatial mapping of valley splitting in a Si/SiGe shuttle device and demonstrate that selecting shuttling trajectories to avoid regions of low splitting enables micron scale spin transport with preserved coherence.

Matth Volmer, Tom Stuck & Lars K. Schreiber



Article

19 June 2020 | Open Access

Optical access of spin-polarized excited states in CsPbMnZrCl_6 nanocrystals

High-entropy perovskite nanocrystals prepared via ion exchange show a prolonged spin relaxation lifetime due to Rabi-like effect, which enables the manipulation of optically accessible spin-polarized excited states at room temperature.

Yu Zhang, Haili Liu & Chuang Zhang

Article

19 June 2020 | Open Access

Programmable microwave cluster states via Josephson metamaterials

Microwave cluster states are a key resource for continuous-variable quantum computing, but existing platforms offer limited reconfigurability and scalability. Here, the authors report a demand generation of reconfigurable and scalable multimode microwave cluster states using a programmable Josephson traveling wave parametric amplifier, where tailored pump spectra define the graph connectivity.

A. Accia, R. Celisio & E. Fazio

Article

19 June 2020 | Open Access

Attaining 10.2% solar cell efficiency for non-fused ring electron acceptors via multi-directional charge transport

Non-fused ring electron acceptors (NR-EAs) are limited by their electron transport efficiencies for solar cells. Here, the authors introduce supramolecular interaction sites on the side groups of NR-EAs to construct multi-dimensional charge transport channels for higher performance solar cells.

Miao Li, Qianqian Zhu & Yuhui Lu

Article

19 June 2020 | Open Access

Flexible infrared camouflage eutectic gallium–indium for thermoelectric energy harvesting

Eutectic gallium–indium is proposed to address the challenge of integrating infrared camouflage with self-powered thermoelectric sensing, enabling simultaneous concealment of thermal signatures and real-time physiological monitoring without complex fabrication.

Zechang Wei, Min Seok Kim & Saeed Ching Tan

Article

19 June 2020 | Open Access

Atomically precise $\text{Au}_3\text{Pd}_3(\text{DPPF})_2^{2-}$ catalyst orchestrates the synthesis and utilization of hydrogen peroxide

Atomically precise metal clusters that combine structural clarity, functional modularity, and spatial programmability are becoming increasingly relevant. Here, the authors report the synthesis and applications of the cluster-based $\text{Au}_3\text{Pd}_3(\text{DPPF})_2^{2-}/\text{Au}_2\text{O}_3$ catalyst for hydrogen peroxide generation.

Xiao Cao, Bai Guo & Qian Zhu

Article

19 June 2020 | Open Access

Process-septate cascade catalysis for highly efficient alkane-to-aromatic conversion

Light alkanes offer a route to key aromatics, but controlling competing catalytic steps remains difficult. This study separates and matches reaction stages to boost benzene, toluene and xylene production.

Jianhua Cai, Hua Xiao & Jieping Gong

Physical sciences articles within Nature Communications



Featured

Article 22 June 2024 | Open Access
Ligand-mediated suppression of Ostwald ripening enables low-temperature sol-gel ZnO for efficient inverted flexible organic photovoltaics

Solar cells using sol-gel ZnO are typically limited by the high temperature processing that is incompatible with plastic substrates. Here, the authors present a ligand-directed strategy using DMNPs that stabilizes the process, thus producing high quality ZnO at 70–90 °C for rigid and flexible solar cells.

Jiaojiao Zhang, Chi Xu & Ziyi Ge

Article 22 June 2024 | Open Access
Direct Construction of Magnetic and Electrical Two-Dimensional Radical Covalent Organic Frameworks

The direct synthesis of 2D radical covalent organic frameworks (RCOFs) from radical precursors remains a significant challenge. Here, the authors report the bottom-up synthesis of hexagonal 2D RCOFs in which radical units are retained within the framework backbone.

Najafzadeh Pashaei, Hoshino, Hashimoto, Oishi & Shiozaki

Article 22 June 2024 | Open Access
Autoantigen-loaded Polymeric Microparticles associate with B cells and promote tolerogenic antigen presentation in a mouse model of experimental autoimmune encephalomyelitis

B-cell dysregulation is a key feature of autoimmunity, and strategies to target pathogenic B cells are highly desirable. Here, the authors show that autoantigen-loaded polymeric microparticles associate with the surface of B cells in vivo and induce regulatory B cells, achieving antigen-specific tolerance and promoting therapeutic efficacy in a mouse model of experimental autoimmune encephalomyelitis.

Nicole Rose Lueken, Brian G. Barbary & Kirsty M. Ansell

Article 22 June 2024 | Open Access
Sterically protected π -electron systems for efficient solid-state photon upconversion

A solid-state visible-to-ultraviolet upconversion system is developed using suitably alkyl functionalized acceptors. Recombining fast triplet energy diffusion and high luminescence intensity enables 1.5% conversion at solar-level irradiance (1.2 mW cm⁻²).

Natsumi Harada, Hayato Shoyama & Nobuo Kurokawa

Article 22 June 2024 | Open Access
Aromaticity and structure switching of cyclopropanemetalindole to metallaquolinium

Aromatic ring is stable, making it hard to reshape their frameworks. Here, the authors convert one metal-containing aromatic ring into another, offering a new route to meta-aromatic compounds.

Bingqi Fu, Yue Zhao & Wei Bai

Article 22 June 2024 | Open Access
Spatiotemporal modulation of surface texture for information encoding and object manipulation

Dynamic control of surface textures is limited by static or coarse patterned approaches, restricting their application in programmable object manipulation and information encoding. This study achieved reversible, spatiotemporally programmable surface texturing on a photothermal liquid crystal elastomer bilayer, enabling precise, on-demand surface patterning, object propulsion, self-sealing information encoding, and reversibly assembly processes through localized light stimuli.

Xiao Wang, Jinyi Shi & Shuhua Xie

Article 22 June 2024 | Open Access
Non-equilibrium stratification in supercritical CO₂

Supercritical fluids, e.g. carbon dioxide, exhibit complex behavior under non-equilibrium conditions, challenging traditional views of phase homogeneity. This study experimentally demonstrates the spontaneous stratification of supercritical CO₂ into distinct layers with varying thermodynamic properties when subjected to a temperature gradient, revealing the limits of classical thermodynamics in describing such systems.

Paul Fulton, Emma Lucif & Fabrizio Crocillo

Article 22 June 2024 | Open Access
Anion-exchange fluorinated ion conductors for stable high-voltage lithium battery

Conventional fluorination cannot resolve the stability/transport trade-off in solid electrolytes. Here, authors report core-shell Li₂Fluoride/Li₂Nano composite precursors to synthesize heavily fluorinated Li⁺ and Li⁺-anion electrolytes with both high ionic conductivity and good oxidative stability.

Caoyang Li, Jingyong Yao & Long Zhang

Article 22 June 2024 | Open Access
Strain-coordination strategy enabling long-cycling all-solid-state lithium-sulfur batteries

All-solid-state lithium-sulfur batteries are limited by the high external pressure needed to maintain interfacial stability. Here, the authors develop a strain-coordination strategy that enables coping electrode volume changes during cycling to reduce stress buildup and enable stable operation under lower pressure.

Jiansi Zhang, Shengjie Xia & Changsheng Wang

Article 22 June 2024 | Open Access
Collaborative passive cooling of impact-hardening interfaces enabled by nacre-mimetic design

This study presents a nacre-inspired material that passively cools outdoor devices while absorbing impacts, offering recyclable, low-carbon protection for electronics and equipment in harsh environments.

Zhenqi Li, Sheng Wang & Xinglong Gong

Article 22 June 2024 | Open Access
Molecular sieves in platinum-zirconium zeolite engineers molecular adsorption for highly selective hydrogenation

Metal-zeolite composites are promising heterogeneous catalysts, but their internal microenvironments are not well understood. Here, the authors combine controlled synthesis, catalytic testing, and atomic modeling to map the 1D environments of platinum in 4RT zeolites, linking zeolite geometry directly to catalytic performance.

Kaosheng Xie, Shunhan Fan & Tefeng Wang

Article 22 June 2024 | Open Access
Bypassing Schottky constraints via defect-mediated hydrogen transfer in hydrodechlorination

This study shows that defect vacancies in MoS₂/Fe(OH)₂ open defect-assisted electron pathways that bypass Schottky barriers, mobilize active hydrogen and drive selective chloroform hydrogenolysis.

Shuang Zhu, Haoran Chen & Li-Zhi Huang

Article 22 June 2024 | Open Access
Solving the Hubbard model with neural quantum states

Accurately solving the doped two-dimensional Hubbard model is challenging due to strong correlations and finite size effects. Here, the authors present a problem-based neural quantum state with an adaptive entanglement scheme that achieves state-of-the-art accuracy on large lattices, capturing phase ground states and reducing boundary artifacts.

Yuxuan Gu, Wenxin Li & Dinghan Lu

Article 22 June 2024 | Open Access
Deterministic, dynamically reconfigurable single quantum emitters enabled by tip-enhanced nano-optical trapping spectroscopy

A tip-enhanced nano-optical trapping spectroscopy enables deterministic trapping and dynamic control of single quantum emitters, including reversible switching between weak and strong light-matter coupling regimes.

Yueyuegong Xue, Jianhui Shen & Xinyang Qu

Article 22 June 2024 | Open Access
Enhanced energy storage performance of confined co-doping dielectric films via nanoparticle self-assembly in ferroelectric phases

The authors present a confined co-doping strategy for polymer-based dielectric films by incorporating BaTiO₃ and Al₂O₃ nanoparticles into the ferroelectric film of covalent electroactive films. The enhanced performance arises from the synergistic effects of high-polarization BaTiO₃, wide-bandgap Al₂O₃, and BaTiO₃/Al₂O₃ heterointerfaces.

Kun Xing, Qi-Ze Han & Zhi-Min Dang

Article 22 June 2024 | Open Access
Enzyme-inspired single-molecule photocatalyst enables singlet-oxygen-driven asymmetric epoxidation and sulfoxidation

The development of catalytic systems for the enantioselective epoxidation of sterically hindered trisubstituted alkenes and the oxidation of sulfenols to sulfoxides using molecular oxygen (O₂) as the terminal oxidant remains a formidable challenge. Here, the authors report a biomimetic bifunctional photocatalyst that integrates a chiral macrocyclic unit and a covalently tethered enantioselective photosensitizer within a single molecular scaffold.

Yiwei Chen, Wanglong Liang & He Long

Article 22 June 2024 | Open Access
Negative-curvature interfaces enable highly synergistic strength-ductility-toughness at 77 K

Here, authors engineer coherent nanoprecipitates with negative-curvature interfaces in the NiCoCr-AlTi system, adding a prolific source of dislocation nucleation and leading to enhanced cryogenic mechanical performance.

Dongdong Zhang, Jinyu Zhang & Zhen Chen

Article 22 June 2024 | Open Access
A chemoproteomic biotechnological toolkit for resolving silylase specificity in decorated silyl

Silyl is a complex plant polysaccharide with chemical decorations that shape its degradation. Here, the authors develop selective probes for silylases targeting these structures in biological samples, offering a powerful approach for enzyme discovery and optimization for biotechnology.

Thany L. S. Costa, Zhen Li & Gordon J. Day

Article 22 June 2024 | Open Access
Generating synthetic multi-national longitudinal cohorts for clinically grounded HIV research

Data from longitudinal cohorts of people living with HIV are highly valuable but privacy concerns limit data sharing. Authors present a method for generating shareable synthetic datasets that preserve the statistical structure of the real data.

Zhuchao Li, Liang Zhuochang Li & Chao Yan

Article 22 June 2024 | Open Access
Estimating high-resolution albedo for urban applications

This study introduces a high-resolution (30-m) urban albedo dataset created by fusing Sentinel-2 and commercial imagery. The authors demonstrate how building-level rooftop planning could mitigate extreme heat by up to 3.2 °C in summer cities.

David Fork, Elizabeth L. Weisley & Lucy R. Hudya

Article 22 June 2024 | Open Access
A unified platform for the rapid assembly of glutarimides for Cerebin B3 ligase modulator drugs

Glutarimide-containing CBB ligands are central to targeted protein degradation but remain synthetically challenging. Here, the authors report a unified organocatalytic platform enabling rapid, selective, and scalable assembly of diverse glutarimides, facilitating library synthesis and late-stage functionalization.

David M. Whalley, Oliver Lumbrie & Alfie Woodhouse

Article 22 June 2024 | Open Access
Structural superlubricity triboelectric nanogenerator with negligible wear and high triboelectrification efficiency

The work builds a sliding triboelectric generator using structural superlubricity between graphite and silicon oxide. Atomic-scale contact yields near-zero friction, suppresses air breakdown, minimizes wear, and delivers stable, enhanced charge output over long cycling.

Changhe Chen, Jiahui Nie & Yuliang Zou

Article 22 June 2024 | Open Access
Lipopolysaccharide hydrolysis-targeting nano-chimeras detoxify endotoxin through specific adsorption and efficient degradation

Detoxifying the endotoxin lipopolysaccharide (LPS) remains challenging. Here, the authors show that the brush-coated protein-LPS binds LPS with high affinity and develop plant-derived nanovesicles displaying native LPS, combined with cerium-based nanoczymes, to enable LPS hydrolysis.

Lulu Jin, Chengyue Zhang & Xiaodong Zhou

Article 22 June 2024 | Open Access
smDeepFLUOR: single-molecule deep learning fluorescence classification

Single-molecule fluorescence imaging struggles to distinguish signals from different molecular events when intensity profiles appear similar. Here, the authors introduce smDeepFLUOR, a deep learning framework that classifies spontaneous fluorescence signals with high accuracy across diverse physical models, revealing subtle differences imperceptible to conventional analyses.

Jianhui Lu, Yiyang Guo & Jiong Jiong Lu

Article 22 June 2024 | Open Access
Dynamic palladium catalysis enables chiral amplification under acyclic Schiff base atropisomers

Acyclic Schiff base atropisomers have remained inaccessible because of longstanding synthetic and mechanistic challenges. Here, the authors report a palladium-catalyzed asymmetric N-alkylation enabled by substrate-guided catalyst evolution, delivering 2 selective atropisomers Schiff bases with high yields and enantioselectivities.

Qi Liu, Jun Du & Ying He

Article 22 June 2024 | Open Access
Solving the vibrational Schrödinger equation with artificial neural networks

Solving the full-dimensional vibrational Schrödinger equation remains challenging for polyatomic molecules. The authors present an efficient neural network approach for accurate vibrational energy calculations for molecules with more than ten atoms.

Shunhuihui Zhao & Dong H. Zhang

Article 22 June 2024 | Open Access
Axion electrodynamics in a topologically trivial antiferromagnet

It is possible to realize axion electrodynamics in a material with an isotropic and linear magnetoelectric response. However, such a material has thus far evaded experimental realization. Here, Mishra et al. succeed in creating such a linear isotropic magnetoelectric response in powdered Chromite.

Abhishek Mishra, Robin Karthikeyan & Christian Dene

Article 20 June 2024 | Open Access
Direction-resolved nanoscale optical imaging with near-nanometer resolution by emerging infrared torsional force microscopy

Probing nanoscale light-matter interactions requires simultaneous access to optical anisotropy and ultrahigh spatial resolution. Here, authors develop torsional force microscopy-infrared imaging enabling near-nanometer optical imaging and direction-resolved mapping of local optical responses.

Yunhan Gao, Son T. Le & Min Ouyang

Article 20 June 2024 | Open Access
Overcoming chromium poisoning in solid oxide cells through multivalent perovskite engineering

Chromium poisoning and sluggish oxygen kinetics limit oxygen electrodes in reversible solid oxide cells. Here, the authors report a triple-barrier perovskite that suppresses Sr segregation, traps chromium, and tunes surface chemistry, enabling strong chromium tolerance and long-term stability.

Min Li, Huihui Liu & Zhenrong Wang

Article 20 June 2024 | Open Access
Model contrast engineering in ultraviolet and visible metalenses enabled by material-selective hybridization

The authors present a material-selective hybrid metalens that produces high-efficiency performance in distinct spectral windows without geometric modification. The work establishes hybrid metalenses as a manufacturing-compatible alternative to bulk refractive optics.

Jiahua Song, Younggun Jeon & Junsuk Rho

Article 20 June 2024 | Open Access
Cobaltine-catalyzed reductive hydrogen atom transfer for alkene and allylic carbonylation with branched alkenes

The authors report a regioselective hydrogen atom transfer process that enables divergent carbonylation of branched alkenes. Through modulation of the electronic and steric properties of the ligands, the cobalt complex achieves precise discrimination between hydrogen atoms exhibiting minor differences in bond dissociation energies (BDEs), affording vinyl and allylic amides with predictable selectivity.

Ziyi Jiang, Jing-Ran Shen & Jianmin Zhao

Article 20 June 2024 | Open Access
Chiral chromophore engineered donor for constructing circularly polarized organic long-persistent luminescence exciplex

Organic long-persistent luminescent materials with chirality are desirable but hard to obtain. Here, the authors report the development of such materials with exciplex emission as a result of a charge transfer process.

Xin Yan, Yunliang Ji & Wei Huang

Article 20 June 2024 | Open Access
Ambient pressure recovery of the structurally unconventional hydride Y₂Fe₂H₂

A hydrogen-rich material, Y₂Fe₂H₂, is synthesized at more than 80 GPa and remains metastable at ambient conditions for days. The combination of single-crystal x-ray diffraction and ab initio structural search allow to determine its structure.

Mathieu Causse, Loïc Toraille & Paul Loucheur

Article 20 June 2024 | Open Access
Solvent-triggered reconfiguration of optical physical unclonable functions

Researchers report a reconfigurable optical anti-counterfeiting tag whose microscopic fingerprint can be rewritten on demand by a droplet of liquid solvent, enabling irreversible security under heat, light, or special equipment.

Ji Hoon Kim, Jihye Kim & Won-Bo Lee

Article 20 June 2024 | Open Access
Tetravalent organic cation-enabled dual interfacial regulation for durable aqueous zinc-iodine batteries

Interfacial instability limits aqueous zinc-iodine batteries. Here, the authors introduce a high-valent organic cation electrolyte that electrostatically engineers bipolar interfaces to suppress polysulfide shuttling and regulate Zn deposition, resulting in markedly improved cycling stability.

Doudou Feng, Yueshuo Shi & Jijie Xu

Article 20 June 2024 | Open Access
N-Bordered Rylene Arches via Programmable Curved π -Extension

Curved macrocyclic carbons have generated interest for their distinct properties that are sensitive to strain, implying a strong coupling between the macrocyclic and lattice degrees of freedom. Here, the authors create electron-rich dianion vacancies in a rare-earth carbide catalyst, providing a promising route to efficient and stable aromatic synthesis under mild conditions.

Kai Chen, Zhenyu Li & Zhaohui Wang

Article 20 June 2024 | Open Access
Hydroxyl chemistry regulation of cellulose biopolymers for aqueous zinc battery binders

Cellulose is an abundant and sustainable material, but its molecular chemistry remains undesired in battery designs. Here, authors tailor cellulose hydroxyl chemistry to produce multifunctional binders that stabilize aqueous Zn battery electrodes and improve cycling stability and rate performance.

Rongli Xu, Ningxin Chen & Zhaohui Wang

Article 20 June 2024 | Open Access
Biomimetic ferroelectric-semiconductor transistor enables neuronal multisensory integration

Applying the brain's multisensory integration is vital for artificial intelligence. Liu et al. have developed a biomimetic ferroelectric-semiconductor field-effect transistor to mimic the brain's additional integration driven by hardware-native multi-physics coupling.

Shao Liu, Jigang Zhang & Ming Ye

Article 20 June 2024 | Open Access
Creation of a computational space with model-free metasurface neural network

Physical neural networks promise fast and energy-efficient computing but are difficult to train in complex environments. Here, the authors create a computational space that learns from electromagnetic interactions, enabling wave focusing, object recognition, and localization without digital models.

Minghui Song, Chao Qian & Hongsheng Chen

Article 20 June 2024 | Open Access
Practical and divergent electrochemical access to thiochromoyl fluorides and N-trifluoromethyl amines from secondary amines

The authors report a practical and divergent electrochemical method for converting simple secondary amines into thiochromoyl fluorides and N-trifluoromethyl amines, proceeding under mild, open-air conditions without solvent drying, degassing, inert atmosphere, or stoichiometric silver reagents.

Feifei Li, Polikarova, Daniel F. Canales & Kevin Lam

Article 20 June 2024 | Open Access
Dynamic heterogeneity in the self-induced spin glass state of elemental neodymium

Elemental heterogeneity relates to particular local length scales in glassy materials that persist over time. While well-studied across a range of glassy materials, its presence in spin glasses remains unclear due to the requirement of nanoscale imaging. Here, using spin-polarized scanning tunneling microscopy, Nagai et al. image dynamic heterogeneity in real space in a self-induced spin glass.

Lauree Nagai, Julian S. Stirk & Alexander A. Tsvetkov

Article 20 June 2024 | Open Access
An autonomous lab for data-driven homogeneous catalysis

The authors report a practical and data-driven autonomous catalytic platform that couples parallel miniaturized batch reactors for pressurized gas-liquid transition strategy to facilitate high-throughput Bayesian optimization framework for rapid discovery (ligand identity) and continuous process variables.

J. A. Bennett, N. Oroski & M. Alkhalaf

Article 20 June 2024 | Open Access
Water-modulated conformational heterogeneity underlies multiple timescales of primary charge separation in photosystem II

Photosystem II converts sunlight into chemical energy via ultrafast charge separation. Here, the authors show that water molecules in protein channels drive the multi-timescale electron transfer kinetics from multiple quantum/classical simulations.

Mathew Capone, Ally Benney & Isabella Caidone

Article 20 June 2024 | Open Access
Cooperative chelation for high-performance perovskite light-emitting diodes

Molecular additive engineering provides light-emitting devices, but single additive cannot passivate defects across multiple crystal planes. Li et al. use two cooperative additives to bind different planes, slowing growth and boosting efficiency, radiance, and stability.

Rui Li, Chuanxin Fan & Zhi-Rong Yin

Article 20 June 2024 | Open Access
Observation of magnon polarons in the van der Waals itinerant ferromagnet Fe₃GeTe₂

Two-dimensional magnetic materials have magnetic properties that are sensitive to strain, implying a strong coupling between the magnetic and lattice degrees of freedom. Here, using ultrafast scanning tunneling spectroscopy (STS), lateral, and Coulomb find the lattice dispersion of magnon polarons in the two-dimensional ferromagnet, Fe₃GeTe₂.

Gali Li, Namrata Samal & Wulf von Klitzsch

Article 20 June 2024 | Open Access
Isolation and reactivity of an alkyl-substituted germanium(II) radical anion

Low-valent main-group radicals are difficult to isolate because they are highly unstable. Here, the authors report a stable germanium radical anion and reveal its structure, bonding and oxidative reactivity.

Chengfeng Fan, Yanhui Bi & Zhaoshen Dong

Article 20 June 2024 | Open Access
Entropy-driven order-to-disorder transition in perovskite anodes for high-performance solid oxide fuel cells

Carbon deposition and insufficient reactivity hinder the development of anodes in solid oxide fuel cells. Here, authors propose an entropy-induced order-disorder transition strategy to facilitate high-entropy anodes to attain improved catalytic activity and durable cycling resistance.

Guo Wang, Rongrong Ren & Kening Sun

Article 19 June 2024 | Open Access
Koopman global linearization of contact dynamics for robot locomotion and manipulation enables elaborate control

Robust contact enables the use of Koopman operators with sufficient accuracy to control inputs. This enables the convex Model Predictive Control of a legged robot, and the real-time control of a gripper engaged in dynamic juggling.

C. Noll, J. Tomasek & H.-H. Jun

Article 19 June 2024 | Open Access
Electron-rich dianion vacancies boost diazenide intermediates for efficient chemical looping ammonia synthesis

Activating dinitrogen under mild conditions remains a central challenge in ammonia synthesis, driving the search for electron-rich active sites that can facilitate N₂ activation and lower reaction barriers. Here, the authors create electron-rich dianion vacancies in a rare-earth carbide catalyst, providing a promising route to efficient and stable ammonia synthesis under mild conditions.

Jiaojiao Wang, Bo Dai & Tian-Tian Xu

Article 19 June 2024 | Open Access
In situ graphene-seq: spatial transcriptomics and chronic electrophysiological characterization of tissue microenvironments

Biological tissues exhibit coupled electrical activity and gene expression that are difficult to measure simultaneously. Here, authors introduce an in situ graphene sequencing, integrating electrophysiology with spatial transcriptomics to enable multimodal characterization of tissue microenvironments.

Jiaying Liu, Wenbo Wang & Jia Liu

Physical sciences articles within *Nature Communications*

Atom

BSS feed

Featured

Article

25 June 2026 | Open Access

Hydrogen bond stabilized ¹³CO intermediate enables CO₂ electroreduction to multi-electron products on silver catalysts

Electrochemical CO₂ reduction on silver is often limited to two-electron products due to weak intermediate adsorption. Here, the authors report a molecular modification strategy that uses hydrogen bonding to stabilize intermediates, enabling the formation of multi-electron products.

Wenbo Zhang, Yifei Zhang & Chuanxin He

Article

25 June 2026 | Open Access

Quantum Fisher information as a thermal probe in frustrated magnets through insights from quantum spin ice

Quantum Fisher information is a rapidly developing tool for measuring entanglement accessible in indetect neutron scattering experiments, but its broader utility for characterizing quantum phase remains unclear. Here, the authors propose that temperature and momentum resolved quantum Fisher information can quantitatively map phase boundaries and crossover to liquid and spin ice.

Chengyang Zhou, Zhengzhang Zhou & Zi Wang Meng

Article

25 June 2026 | Open Access

Force-moment mechanics of wiggling in connector insertion

The authors explain why people wiggle connectors during insertion. A simple two-kg mechanical model shows combining vertical force with small rotational moments overcomes friction, reducing effort, jamming, and enabling efficient assembly.

Jumin Park, Yun Kang & Joonyoung Cheong

Article

25 June 2026 | Open Access

Divergent effects of pathological α -synuclein truncations and mutations on phase separation

This study shows how disease relevant sequence alterations affect phase separation and aggregation behavior of α -syn. Notably, terminal truncations favor phase separation and aggregation and diminish interaction with other condensates.

Soumik Ray, Antonin Kurba & Alexander K. Buell

Article

25 June 2026 | Open Access

Rare-Earth modified biodegradable Zn alloys with high strength and enhanced osteogenesis

Low mechanical strength limits biodegradable orthopaedic implant use. Here, the authors develop a biodegradable Zn-Mg-Y alloy approaching the strength of medical grade titanium alloy implants that promotes bone healing by controlled release.

Jiahui Shi, Mingyao Gu & Yulong Zheng

Article

25 June 2026 | Open Access

Universal graph-based identifiers of chemical structures for linking large material databases

The lack of universal identifiers for chemical structures impedes efficient utilization of large databases. Here, the authors introduce Graph ID based on atomistic distances in the structure allowing efficient distinguishing between diverse materials.

Koki Muraseki, Seta Tsutsui & Akira Nakayama

Article

24 June 2026 | Open Access

Intrinsically nonlocal metamaterials

Electromagnetic nonlocality due to free electron motion is often associated with small corrections to the response of nanoscale conductive circuits. Here, the authors demonstrate that in metamaterials nonlocal interactions can quantitatively alter macroscopic optical properties of the composites.

A. Wari, S. L. Saito & B. V. A. Rodaskey

Article

24 June 2026 | Open Access

A mechano-integrated gradient electrolyte for long-cycling solid-state lithium metal batteries

Solid-state lithium batteries suffer from interfacial instability. Here, authors develop a mechano-integrated gradient electrolyte with a viscoelastic polymer and graded ionic architecture, enabling stable lithium plating/stripping and Li/LiPF₆ salt cycling, while supporting high-speed roll-to-roll manufacturing.

Xiaoping Yi, Guojing Qi & Hong Li

Article

24 June 2026 | Open Access

Spatiotemporal flux breathing and topological sculpting in structured transverse orbital angular momentum lattices

This study shows how ultrafast optical vortices can be shaped into programmable space-time lattices, creating new ways to control light flow and encode information for high-dimensional optical communication.

Dawei Liu, Xingqian Zhang & Qiyun Zhao

Article

24 June 2026 | Open Access

Flexible artificial compound eye cameras for ultrawide continuous tracking in mixed reality

Researchers developed a flexible artificial compound eye camera inspired by fruit flies that combines panoramic vision, active tracking and AI processing to achieve 270° imaging, low-light motion tracking and ultrafast mixed-reality interaction.

Heng Jiang, Chi Chung Tsui & Xuming Zhang

Article

24 June 2026 | Open Access

Coherent control of quantum-dot spins with cyclic optical transitions

Simultaneous spin control and single-shot readout are key to generating photonic resource states and have remained challenging in semiconductor quantum dots. Here, the authors demonstrate high-fidelity optical control of an electron spin qubit in GaAs and InGaAs quantum dots while preserving high optical quality for spin-selective transitions.

Zhe-Kuan Kuo, Lily Hsu & Dylan A. Gangloff

Article

24 June 2026 | Open Access

Dichrography: two-frame ultrafast imaging from a single diffraction pattern

Dichrography enables two-frame modes of isolated nanostructures at femtosecond frame rates. This method unlocks opportunities for recording, tracking, and ultimately controlling elusive ultrafast processes at the nanoscale.

Linao Hecht, Andre Al-Haddad & Alessandro Colombo

Article

24 June 2026 | Open Access

Site-controlled quantum dot arrays edge-coupled to integrated silicon nitride waveguides and devices

Scalable quantum photonic architectures require deterministic integration of many identical quantum light sources with photonic circuits. Here, the authors demonstrate alignment and edge-coupling of arrays of the controlled GaAs quantum dots to SiN waveguides at cryogenic temperatures, achieving deterministic emitter-waveguide coupling with reproducible efficiency across an array.

John O'Hara, Nicola Marangola & Emanuele Pellicci

Article

24 June 2026 | Open Access

Overcoming the wettability issue of heterogeneous metal catalysts for solvent-free organic transformations

The authors present an inorganic rhodium catalyst obtained by coating subnanometer rhodium clusters within a self-pillared zeolite structure. This catalyst design not only stabilizes the subnanometer active sites but also facilitates efficient mass transport properties during solvent-free cyclic hydroformylation reaction.

Chaofeng Zhu, Xiaomeng Dou & Lichen Liu

Article

24 June 2026 | Open Access

Spiking neural network decoders of finger forces from high-density intramuscular microelectrode arrays

Decoding finger forces requires accurate and efficient estimation of motor intent. Here, the authors show that spiking neural networks enable precise, low-cost decoding from high-density intramuscular EMG using motor unit activity or directly encoded muscle signals.

Farah Barakat, Agnese Grillo & Eliaa Donati

Article

24 June 2026 | Open Access

Electrothermal vacuum sublimation drying of graphene aerogels for high-temperature synthesis

Electrothermal vacuum sublimation drying under pressure and temperature control based on the water phase diagram, it quickly dries frozen graphene aerogels and supports wider applications in high-temperature synthesis.

Su Fan Yu, Ming-Qi Yang & Zhong-Qin Tian

Article

24 June 2026 | Open Access

Hypernetworks induce stable hyperlocking

Higher-order interactions, such as those found in hypernetworks, are increasingly recognized for their significance in complex systems like the brain and ecosystems, where traditional pairwise interaction models may fall short. This study reveals a synchronization phenomenon termed "hyperlocking," which occurs in hypernetworks, demonstrating the emergence of a stable phase locking with higher-order relations between the frequencies.

Edoardo Nijholt, Tago Pereira & Jorgens Kurths

Article

24 June 2026 | Open Access

Ionically self-assembled monolayers enable neutral interfaces and synergistic charge extraction in high-efficiency perovskite solar cells

Self-assembled monolayers are common hole-selective contacts in inverted perovskite solar cells, but acidic head groups reduce interface quality. Yang et al. neutralize these groups with alkali metal phosphonate salts and mixed layers, improving charge extraction, stability, and efficiency.

Yuxuan Yang, Deimante Kriukne & Yi Zhang

Article

24 June 2026 | Open Access

Development of response-controlled tall buildings through own-mass mobilisation

Authors explore an alternative mass damping technique. The study demonstrates that mobilising a portion of a tall building's own mass using spring dampers reduces wind and seismic responses, achieving over 70% reduction in peak accelerations and 50% in base moments, with minimal differential floor movements.

Miguel Martinez-Pareda, Ahmed Y. Elghamouli & William Algaud

Article

24 June 2026 | Open Access

Mesh-represented and learning-empowered hologram synthesis for full 3D holographic displays

The authors describe a method for rendering mesh scenes into complex-valued wave fields, before computing phase-only holograms using complex-valued superposition instead of amplitude-only objectives. This enables full 3D holography with smooth defocus blur, continuous depth perception, and view-dependent effects.

Xiangyu Meng, Wenbin Zhou & Yifan Peng

Article

24 June 2026 | Open Access

Near-infrared stress memory emitters enable delayed impact visualization in illuminated environments

Mechanical detection often requires complex real-time analysis. Here, authors develop near-infrared stress memory emitters that enable delayed, direct visualization of impact events under ambient illumination with high accuracy and minimal processing time.

Xin Zhang, Shuchun Li & Feng Wang

Article

24 June 2026 | Open Access

Breaking high-temperature dielectric energy storage limits through suppression of charge carrier transport

The authors achieve high-temperature dielectric energy storage properties via a Lewis-basic anionic poly(etherimide)s. Lewis acid tri (perfluorophenyl)borane compounds in a strict electronic migration blocking strategy.

Lai Zhang, Xuan Zhao & Xiangqiang Li

Article

24 June 2026 | Open Access

Generic generation and manipulation of high-dimensional spin-orbit states in Hilbert space

The study presents a metasurface for generating high-dimensional spin-orbit light and a three-interferogram scheme to characterize it, reveals a parity order that enforces symmetry, and shows mode switching through higher-order geometric phases.

Pujin Li, Ruihui Zhao & Lingling Huang

Article

24 June 2026 | Open Access

Diffusive memristors in the edge of chaos

Biological nervous systems operate at the edge of chaos for efficient information processing. Kim et al. realize such biological dynamics in diffusive memristors, achieving three orders of magnitude higher power efficiency than other devices with comparable functionalities.

Seung Ju Kim, Tong Wang & J. Joshua Yang

Article

24 June 2026 | Open Access

Cyclic sulfone ring remodeling enables molecular shape diversity-oriented synthesis of privileged biaryl and oligoaryl motifs

The authors report the development of regioselective nucleophilic/electrophilic cycle-mediated cyclic sulfone ring remodeling that can streamline access to a wide range of biaryl and oligoaryl scaffolds, featuring aliphatic and heteroaromatic amines, phenols, thioethers, and phosphines.

Viet D. Nguyen, Sachchida Nandi & Qing Y. Liao

Article

24 June 2026 | Open Access

Assembly-Line Biosynthesis in Living-Cell Emulsions via Tunable Supramolecular Surface Chemistry

Natural enzymes are organized in micro-compartments for efficient biosynthesis. Here, the authors replicate this by modifying E. coli with oil-derived photocatalyst to self-assemble at the interface of Pickering emulsions, stabilizing them and allowing more efficient chemocatalytic and multienzyme cascades.

Xiankun Wu, Mathias Dindler & Changhui Wu

Article

24 June 2026 | Open Access

Ultra-broadband ultraviolet detection and imaging enabled by copper-halide inside transparent glass

Broadband ultraviolet detection is needed for defense, but existing systems struggle to cover deep wavelengths due to limited bandgap control. Zhang et al. developed a multi-bandgap glass device that converts deep ultraviolet light to visible, enabling efficient wide-range detection and imaging.

Hao Zhang, Hong Ju & Guoping Dong

Article

24 June 2026 | Open Access

hexABC seeking the physical code of DNA

DNA's physical properties are key to gene regulation and protein binding. Here, authors use massive simulations to map all 2,880 unique DNA hexamers, revealing a "physical code" that explains how sequence mechanics shape genome evolution.

Federica Battistini, Mikosz Wencio & Modesto Orozco

Article

23 June 2026 | Open Access

Optimal dismantling of directed networks

Dismantling directed networks is critical for controlling complex systems. Here, authors introduce TAD, a tripartite analysis-based method that efficiently fragments networks by targeting nodes with high network incoherence centrality.

Xueming Liu, Bowen Hu & Hai-Tao Zhang

Article

23 June 2026 | Open Access

Framework-templated gas lattices in metal-organic frameworks

Researchers show that metal-organic frameworks can organize confined gases into ordered lattice-like states, opening new ways to control adsorption and gas transport in porous materials.

Younghun Kim, Dohoon Kim & Jihun Kim

Article

23 June 2026 | Open Access

Facile Synthesis of Primary Amines via Nitrogen Fixation in Microdroplets

Primary amines are one of the most versatile intermediates in synthetic chemistry but current methods for their production rely on the use of protecting groups in multiple reactions or the use of complex reducing agents. Herein, the authors report a synthetic, method for primary amines that is based on accelerated microdroplet chemistry.

Rabeulah Kim Strong, Owen L. Lockier & Abraham K. Basu-Tamali

Article

23 June 2026 | Open Access

Ti-functional electrocatalyst with accurate surface reconstruction for zinc-air batteries and water electrolyzers

Exploiting cost-effective electrocatalysts to drive multiple electrochemical reactions could simplify energy devices, but remains challenging. Here, the authors report a double-perovskite electrocatalyst with accurate surface reconstruction for zinc-air batteries and water electrolyzers.

Lingjie Yuan, Wei-Hsiang Huang & Yitong Zhu

Article

23 June 2026 | Open Access

Creation of an air-stable surface electrode and its application to ammonia synthesis

Air- and moisture-stable electrodes have shown promise for catalysis but remain challenging to apply in practice. Here, the authors report oxygen-doped Ba₂NiO₃ as the first air-stable surface electrode and demonstrate its application in ammonia synthesis.

Zhujun Zhang, Shiyao Wang & Hideo Hosono

Article

23 June 2026 | Open Access

Sustainable trans-scale fibrous membranes for stable ultra-protective air filtration

Fibrous air filtration media are promising for personal protection, though fabricating ultrafine nanofibers and designing topological filtration networks are challenging. Here the authors report an electrospinning strategy to design a particulate matter filtration membrane.

Yuchen Yang, Xiangchun Li & Jianying Huang

Article

23 June 2026 | Open Access

Varifocal Alvarez metalens array for adaptive light-field imaging

Conventional lens arrays usually have fixed focal lengths. Here, the authors realize a 24 × 20 varifocal metalens array through lateral displacement of two metalenses, enabling adaptive light-field imaging without increasing system length.

Xianyu Che, Xiaoyuan Liu & Diu Ping Tai

Article

23 June 2026 | Open Access

Relaxor behavior in rocksalt cation-ordered material induced by ferroelectric phase competition

The authors show that relaxor behavior can emerge in a fully cation-ordered oxide through competition between ferroelectric and antiferroelectric phases, revealing a new route to designing high-performance materials without chemical disorder.

Yu Yan, Lijun Wu & Jonathan E. Saylor

Article

23 June 2026 | Open Access

Electrochemical selective oxygen transfer enables energy-efficient environmental deoxygenation

This study reports an electrochemical system that selectively removes oxygen from storage emulsions, reducing energy use in low-oxygen preservation while maintaining product quality and supporting lower-carbon cold-chain logistics.

Deming Li, Yi Tan & Yuan Wu

Article

23 June 2026 | Open Access

Direct imaging-based gradient metasurface sensor enabling spectrometer-free ultrasensitive biomolecule detection

The authors demonstrate a pathway to utilize the continuous geometric gradient in a dielectric metasurface for 0.1 nm spectral step size across a 30 nm spectral window within a 300 µm footprint. The compact sensing platform enables a biosensor for real-time molecular biosensing.

Hongyeon Kim, Heechang Yun & Junseok Kihm

Article

23 June 2026 | Open Access

Dual Photoredox/Cobalt Catalysis Enabled Regioselective Markovnikov Hydroboration of Unactivated Mono-, Di-, and Trisubstituted Alkenes

Hydroboration of alkenes is a key synthetic strategy, yet regioselective Markovnikov functionalization of unactivated especially trisubstituted alkenes remains challenging. Here, the authors report a photoredox cobalt catalyzed method enabling Markovnikov hydroboration via photoinduced metal-halide atom transfer followed by radical boronation.

Xin-Yu Xu, Hong-Chao Liu & Xinya Han

Article

23 June 2026 | Open Access

Self-assembly Monte Carlo reveals localized entanglement in giant polymer melts

Self-assembly underpins the behavior of colloids and atomically thin materials. Here, the authors show that melting with free surface proceeds via double wetting layers, where an intermediate quasi-liquid layer forms between solid and quasi-liquid, invading the bulk ahead of melting.

Wei Li, Tianzuo Zhang & Yulong Wang

Article

23 June 2026 | Open Access

Reasoning in machine vision by learning fast and slow thinking

This work introduces a new approach to AI in which machines improve by "thinking" longer rather than learning from more data. This enables adaptable systems showing strong performance in challenging vision tasks like cancer detection.

Shahen S. Saeed, Yipeng Wang & Daniel C. Alexander

Article

23 June 2026 | Open Access

Explainable generative 3D design driven by social media semantics

This study is on socially informed generative 3D design. Here, authors developed Co3D, an explainable framework linking social media semantics to 3D generation, showing improved structural accuracy, semantic consistency, and interpretable design effects.

Zhenyu Wang, Karen Sato & Prabhat Hansoni

Article

23 June 2026 | Open Access

Quantum estimation with state symmetry-induced optimal measurements

Quantum metrology hinges on measurements that are also optimal in stabilizer code subspaces for metrology.

Jie Yuan Liu, Hai-Long Shi & Siyu Yu

Article

23 June 2026 | Open Access

Learning missing physics from legacy simulators with alternating neural integrators

Alternating Neural Integrators (ANI) offer a non-intrusive "reuse-and-correct" framework to upgrade legacy simulators by alternating prior model evaluation with learned neural corrections, improving fidelity in complex systems and enabling interpretable, data-driven refinement.

Hao Wang, Qinghe Wang & Kaiyang Wu

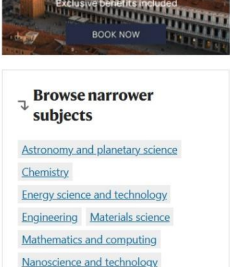
Article

23 June 2026 | Open Access

Ligand-mediated suppression of Ostwald ripening enables low-temperature sol-gel ZnO for efficient inverted flexible organic photovoltaics

Sol-gel-based organo-gel ZnO are typically limited by the high temperature processing that is incompatible with plastic substrates. Here, the authors present a ligand-directed strategy using DMEN that suppresses the ripening, thus producing high-quality ZnO at 70–90 °C for rigid and flexible solar cells.

Jiaqing Zhang, Chi Yu & Ziyi Ge



Browse narrower subjects

Astronomy and planetary science

Chemistry

Energy science and technology

Engineering

Materials science

Mathematics and computing

Nanoscience and technology

Optics and photonics

Physics

Browse Physical sciences across other nature.com journals »

Physical sciences articles within Nature Communications



Featured

Article
27 June 2026 | Open Access
Hyperbranched dielectric polymer networks exhibiting giant energy storage density at 250 °C

To optimize energy transfer and achieve efficient capacitive energy storage in dielectric polymers at thermal extremes, hyperbranched networks are designed to expand inter-chain spacing and suppress secondary relaxation, delivering 4.9 J/cm³ energy density with 50% efficiency at 250 °C.
Zhenyu Qian, Xianli Li & Li Q. Li

Article
27 June 2026 | Open Access
Enhancing molecular property prediction of transformer models with dual graph representation

Molecular representation is critical for property prediction. Here authors introduce a dual graph transformer that fuses atom, bond, topology, structure, and stereoisomeric features within self-supervised pre-training. Here authors reveal a metal center electron affinity mechanism for improving stability and electrochemical kinetics.
Shuyuan Zhang & Alireza A. Lapkin

Article
27 June 2026 | Open Access
Probing mixed-state phases on a quantum computer via Renyi correlators and variational decoding

On a trapped-ion quantum computer, the authors combine Renyi correlators with a variational error-correcting decoder to experimentally distinguish mixed-state phases of a noisy critical string chain, a frontier of open quantum matter.
Yuxuan Zhang, Timothy H. Hsieh & Yijun Zou

Article
27 June 2026 | Open Access
Metal-center electron affinity modulates multicolor electrochromism in 2D conjugated metal-organic frameworks

Two-dimensional metal-organic frameworks show promise for electrochromism, but their coloration mechanism remains unclear. Here authors reveal a metal-center electron affinity mechanism for improving stability and electrochemical kinetics.
Qi Zhao, Jing Yang & John Wang

Article
27 June 2026 | Open Access
Highly robust molecular information carriers for traceability of plastic materials

Sequence-defined oligomers offer programmable molecular architectures but their deployment in real-world materials has been constrained by their low scale. Limited thermal resilience and the need for specialized analytical methods, here the authors introduce a molecular tagging strategy based on aliphatic sequence-defined oligoamides incorporated at ultralow concentrations that endure the thermal and chemical conditions of industrial polymer processing.
Thibault Schütz, Neha Badi & Filip S. Du Prez

Article
27 June 2026 | Open Access
No cloning of quantum ensembles

In this article, the authors analyse the fundamental information-theoretic and computational laws governing the cloning of quantum ensembles, revealing the intrinsic difficulty of observing a wide range of measurement-induced quantum phenomena.
Zhenyu Du, Siyuan Cheng & Xiao Yuan

Article
27 June 2026 | Open Access
Production of aromatics from high density polyethylene over a hierarchical zeolite synthesised from steam-assisted crystallisation

The conversion of high-density polyethylene (HDPE) waste into aromatic feedstocks without using noble-metal catalysts remains a significant challenge. Here, the authors report a steam-assisted synthesized zeolite that enables highly efficient HDPE conversion to aromatics, achieving both high conversion and selectivity at 260 °C, and outperforming noble-metal-based catalysts under the same conditions.
Xinxi Zheng, Meng He & Buxing Han

Article
27 June 2026 | Open Access
Confined ionic order in atomic nanowires of rare-earth chlorides unveiled via symmetry-guided structural screening

Confined low-dimensional materials offer attractive properties, but their atomic structures are hard to resolve. Here, the authors develop a symmetry-guided imaging and modelling approach to identify rare-earth chloride nanowires confined in carbon nanotubes.
Hailuo Zheng, Ryo Nakashiro & Masahiro Yamashita

Article
27 June 2026 | Open Access
Direct observation of long-range many-body coherence in quasi-one-dimensional attractive Bose gases

Attractive Bose gases are modulationally unstable yet exhibit rich nonlinear many-body behavior, owing to the interplay between their coherence and unstable collective excitations. Here, the authors portrait soliton-dynamics dynamics in quasi-1D Bose-Einstein condensates subject to quench dynamics between repulsive and attractive interactions.
Hikaru Tamura, Samir Banerjee & Chen-Lung Hung

Article
27 June 2026 | Open Access
3D nanoprinting of metals by spatiotemporally confined hot electrons via multiple-electron excitations in nanowires

The precision of 3D printing with inorganic materials is limited. Here, the authors demonstrate high-precision 3D printing of metals through laser deposition of nanoparticles using selected photon energies and laser pulse durations.
Kai Wei, Kai Zhang & Hong Fan

Article
27 June 2026 | Open Access
Multidirectional strain-insensitive stretchable RF electronics

Researchers develop a multidirectional strain-insensitive stretchable antenna that maintains stable wireless communication and energy harvesting under large body deformation, enabling reliable wearable health monitoring during natural motion.
Fuxiang Yang, Senhuo Zhang & Chanyun Song

Article
27 June 2026 | Open Access
Broadband Radiative Heat Transfer Suppression via Dispersion-Engineered Metasurfaces

Radiative heat transfer control is crucial for energy efficiency but limited by bandwidth trade-offs. Here, the authors demonstrate dielectric metasurface pairs with misaligned resonances optimized to suppress heat exchange, achieving up to 82% reduction with a compact, robust, metal-free platform.
Lin Jing, Mingze He & Andrea Alù

Article
27 June 2026 | Open Access
Long-distance lanthanide migration regulated by interfacial lattice strain in nanostructures

This microscopy-driven study examines how interfacial lattice strain in the lanthanide nanocrystals drives ions to move across core-shell interfaces, directing crystal growth and optical properties of the nanocrystals, offering a route for heterostructured nanomaterials design.
Yacheng Liu, Xi Zou & Qiangxin Su

Article
27 June 2026 | Open Access
Plasmonic nanocomposite helices for weather-adaptive LIDAR function

LIDAR performance is impaired by water droplets that scatter and distort light. The authors present a biologically coated plasmonic copper nanowires in 3D silica nanohelices enables rapid anti-fogging and strong water repellence while maintaining a three-dimensional structure, clearing condensation in seconds and preserving signal in rain.
Jiayoung Lee, Gyuho Kim & Byoung Ho Jeong

Article
27 June 2026 | Open Access
Brain-inspired spatial intelligence for embodied agents

Integrating biological spatial memory into artificial embodied agents remains an open challenge. Here, the authors develop BIC-Nav, a brain-inspired spatial cognition framework, demonstrating enhanced navigation and general-purpose spatial intelligence.
Shouwei Ruan, Liyan Wang & Heng Su

Article
27 June 2026 | Open Access
Harnessing interfacial click polymerization using pyridinium-ene films as photochromic, radical generation and sensing platforms



Designing organic polymers for visual sensing is highly desirable, yet tuning their properties remains challenging. Here, the authors report interfacial click polymerized pyridinium-ene films that exhibit photochromism, radical generation, and sensing properties.
Xinyu Gou, Xue Gu & Yu Fang

Article
27 June 2026 | Open Access
Electrochemical direct air capture by local alkalinity generation at three-dimensional interfaces

Carbon capture from air using electrochemistry offers a scalable route to removing CO₂ from the atmosphere. Here, the authors report a platform employing a three-dimensional reactive interface to achieve high capture rates with competitive energy consumption.
Aronel Mathur, Zhengyuan Li & Yaqian Liu

Article
26 June 2026 | Open Access
Tunable microwave frequency synthesis with optically-derived spectral purity

Microwave synthesis typically has a trade-off between tuning and spectral purity. This study shows electro-optic frequency division and feed-forward results in an 18 GHz tuning range with optically defined spectral purity, solving the limitation.
James Greenberg, Scott C. Egbert & Antoine Rouland

Article
26 June 2026 | Open Access
Giant tunable barocaloric effects using guest-molecule adsorption in a porous metal-organic framework

Guest-barocaloric effects are demonstrated in a porous metal-organic framework, the operating temperature of which can be tuned via nitrogen adsorption as a caloric device, thus demonstrating good potential for environmentally benign solid-state cooling and heating applications.
Mehmet Olsalci, Giulio Lampertini & Xavier Moya

Article
26 June 2026 | Open Access
Ultrarobust bright single-photon emitters in diamond with strong broadband phonon decoupling

Unwanted coupling to bulk phonons limits the coherence and brightness of solid-state single-photon emitters. Here, the authors report a new nanodiamond color center with a record-narrow room-temperature emission linewidth and strongly suppressed phonon sidebands and propose a general phonon-decoupling mechanism based on coupling to a localized vibrational mode.
Santapadma Sahas, Peter Ubrichshvili & Simon J. Rogerson

Article
26 June 2026 | Open Access
Coupled dual-channel memristors for hardware-native trustworthy Bayesian inference

Probabilistic computing, such as Bayesian neural networks, quantifies predictive uncertainty to prevent overconfident predictions. Liu et al. demonstrate a coupled dual-channel memristor that independently controls synaptic weights mean and variance, enabling trustworthy AI in safety-critical edge applications.
Guowei Liu, Jiaqi Ding & Yanyan Hu

Article
26 June 2026 | Open Access
Observation of localization reversal and harmonic generation in nonlinear non-Hermitian skin effect

Nonlinearly strongly affects topological phases, yet its role in non-Hermitian topology remains little explored. Here, authors show that nonlinearly drives a point-gap topological transition, reversing the non-Hermitian skin effect and controlling harmonic generation via a new three-wave scattering.
Junyan Wu, Hui-Chang Chen & Huanan Xue

Article
26 June 2026 | Open Access
Ligand-controlled sequential activation enables nickel-catalysed alkyl-alkynyl coupling

Cross-electrophile coupling between unactivated alkyl halides and alkynyl halides has long been challenged by reactivity mismatch and poor chemoselectivity. Here, the authors report nickel-catalysed cross-electrophile coupling enabled by a tridentate ligand that controls the sequence of electrophile activation, allowing direct construction of alkyl-alkyl bonds.
Nanyang Kim, Hyun-jeon & Won Jun Jang

Article
26 June 2026 | Open Access
Bubble-assisted cleaning for primary amine oxidation towards amperic-level current densities

Organic oxidation paired with H₂ production is promising yet limited by electrode fouling from insoluble byproducts. Here, the authors report an in situ O₂ bubble cleaning strategy to remove oily products and sustain high current densities.
Xiaochang Liu, Bo Li & Xiaoming Sun

Article
26 June 2026 | Open Access
Ultrafast photoreduction driven by interfacial spin exchange in manganese-doped quantum dots

The authors show that manganese-doped quantum dots enable ultrafast electron transfer and reduce methyl iodide even when conventional band-edge charge transfer is unfavorable, identifying spin exchange as the key driver of hot-carrier photochemistry.
Ho Jin, Valerio Focchetti & Victor I. Klimov

Article
26 June 2026 | Open Access
Probing nuclear interactions à la Rutherford: insights on ⁴He from e scattering

The first scatted state of the ⁴He nucleus represents a long-standing puzzle in nuclear physics, with theoretical and experimental inconsistencies on the estimation of several features. Here, the authors report refined experimental measurements of ⁴He-e scattering, opening potential pathways towards resolution.
F. Cappuzzello, V. Soukoreff & A. Yildirim

Article
26 June 2026 | Open Access
Design and realization of high performance textured lead-free piezoelectric ceramics through human-AI collaboration

The authors demonstrate artificial intelligence guided human-in-the-loop strategy to design high-performance Pb-free piezoelectric ceramics, achieving strong thermal stability and enhanced energy-harvesting performance for next-generation functional devices.
Aman Handa, Debajyoti Bhattacharya & Bal Poudel

Article
26 June 2026 | Open Access
Diverse radical transformations of allenic C(sp)-C(sp²) and C(sp²)-C(sp²) bonds enabled by silyl substitution

While the oxidative cleavage of allenic is well established, the radical-mediated, chemo- and regioselective cleavages of allenic C(sp)-C(sp²) and C(sp²)-C(sp²) bonds remain unresolved challenges in synthetic chemistry. Hereby, the authors present base metal-catalyzed cleavage of allenic C(sp)-C(sp²) double bonds and C(sp²)-C(sp²) single bonds utilizing air as an oxidant.
Zhaoshen Wang, Xiaocheng Gu & Chen Zhu

Article
26 June 2026 | Open Access
Activating bulk S/Se/Te positive electrodes by acidic binder: Induced Cu corrosion for wide-temperature Na-Chalcogen batteries

Sodium-chalcogen battery performance is limited by sluggish kinetics and shuttle effects. Here, authors show how acidic binders can corrode Cu collectors to form Cu₂X (X = S, Se, Te) catalysts, accelerating conversion and suppressing shuttling, enabling bulk S/Se/Te with high capacity up to 10000-cycle life, and low-temperature operation.
Chengming Lu, Boyu Li & Qing Zhao

Article
26 June 2026 | Open Access
Parallel execution of nonlinear logic circuits using reconfigurable free-space diffractive optics

All-optical computing could enable faster, more energy-efficient information processing than electronics. Here, the authors show diffractive optical systems can perform multi-stage nonlinear logic circuits in a single optical stage, enabling basic gates, parallel adders/subtractors, ripple carry adders, and image processing.
Gaoyang R. Bharat, Elliot J. Fuller & François Lévesque

Article
26 June 2026 | Open Access
Programmable Spatial Demixing in Prebiotic Coacervates

Positioning of protocols could be important for interactions and complexity, but control of this is challenging. Here, the authors report the development of coacervates with minor structural changes dictating longevity, and allowing temperature-driven migration and interaction.
Zicheng Xiong, Jie Wang & Yilin Wang

Article
26 June 2026 | Open Access
Topological suppression of quantum tunnelling in a lanthanide single-ion molecular magnet



Quantum phase interference in molecular magnets could provide a route to topological control of spin dynamics but has remained inaccessible in lanthanide systems. Here, the authors report its observation in a 4f single-ion molecular magnet using magneto-spectroscopy, revealing tunnelling splittings and revealing topological tunnelling.
Sagar Paul, Eufemio Moreno-Pineda & Wolfgang Wernsdorfer

Article
25 June 2026 | Open Access
Interfacial epitaxy of single-crystalline Al₂(MoO₄)₃ flakes for anisotropic phonon polaritons

Metal molybdates exhibit interesting anisotropic thermal and mechanical properties, but the synthesis of single-crystalline films and the characterization of their high-stress interactions remain challenging. Here, the authors report the synthesis of single-crystalline Al₂(MoO₄)₃ hosting hyperbolic phonon polaritons in the mid-infrared.
Chunqun Song, Jiaqi Huang & Kaihui Wu

Article
25 June 2026 | Open Access
Sonochemical boron incorporation enhances activity and durability of ruthenium oxide for acidic water electrolysis

Ruthenium oxide is active for acidic water electrolysis but degrades under operating conditions. Here, the authors report a catalytic-mediated sonochemical strategy to incorporate boron into Ruthenium oxide, improving its activity and durability for water electrolysis.
Tianxi Xue, Zhongqiang Liu & Shi-Hong Yu

Article
25 June 2026 | Open Access
Dielectrophoretic and acoustophoretic dual-sensing electrofluorescent display

Researchers developed a dual-sensing display that visualizes dielectrophoretic and acoustophoretic forces. Using laser-controlled microgravity self-assembly, it tracks temperature changes and noninvasively monitors microfluidic channels.
Jong Woong Park, Dongyoun Kang & Cheolmin Park

Article
25 June 2026 | Open Access
Balanced electrochemical reaction kinetics and mass transfer for stable zinc negative electrode

Zinc-ion batteries are promising for safe energy storage but suffer from zinc dendrite growth and corrosion under extreme conditions. Here, the authors find that the balance between electrochemical reaction kinetics and mass transfer is crucial for suppressing dendrites and enabling stable Zn-negative electrodes.
Ao Chen, Shuo Yang & Chunyi Zhu

Article
25 June 2026 | Open Access
Multiparticle entanglement of nuclear spins in silicon

Multiparticle entanglement of silicon spin qubits has been difficult to generate and fully characterize beyond three-qubit Greenberger-Horne-Zeilinger states. Here, the authors demonstrate complete preparation and verification of all nine canonical families of four-qubit entanglement in donor spins in silicon.
Feng Xu, Yi Deng & Tao Xie

Article
25 June 2026 | Open Access
Time-Temperature Superposition Principle Serving as a Design Tool for Tailored MOF-Crystal Glass Composite Membranes

Here authors present a time-temperature superposition strategy to fabricate MOF-based crystalline-glass composite membranes at low temperatures without thermal degradation, with which three membranes are engineered for efficient gas separation.
Ying Chen, Yi Yang & Zhihua Qiao

Article
25 June 2026 | Open Access
Conjugation-induced π -electron modulation in pyridazine-integrated covalent organic frameworks for SO₂ capture and upcycling

SO₂ capture demands sorbents that exhibit high capacity, precise molecular recognition, and robust tolerance under extreme conditions. Here, the authors report a π -carbon-conjugated covalent organic framework engineered with densely aligned and ordered pyridazine groups for efficient SO₂ capture.
Yongfeng Qiu, Fengying Liu & Liang Jiang

Article
25 June 2026 | Open Access
Mechanistic insights into chemical exchange during the signal amplification by reversible exchange sensitization of pyruvate

The study investigates the exchange kinetics in the polarization transfer from paracyclophane to pyruvate via π -pyruvate complexes to pyruvate in signal amplification by reversible exchange (SABRE) hyperpolarization, and finds inconsistencies with previous structural assignments leading to a revised mechanistic understanding of SABRE exchange processes.
Charbel D. Assaf, Vladimir V. Zhovnerko & Jodyly N. Praditschky

Article
25 June 2026 | Open Access
Optimizing reversible solid oxide cell technology for long-term energy storage in Europe's decarbonized frameworks

The study shows that optimized reversible solid oxide cells (RSOC) can store renewable energy over long periods with about 40% round-trip efficiency. Storage needs vary widely across Europe (54-680 kWh/kW_{el}). RSOC-battery hybrid systems are the most economical, cutting costs by up to 78%.
Xinyi Wei, Arthur Wabner & Francois Maréchal

Article
25 June 2026 | Open Access
Simultaneous nanoscale imaging of local conductivity and chemical potential in a quantum Hall isospin ferromagnet

Quantum Hall isospin ferromagnetic phase occurs for integer filling factor quantum Hall states in graphene. In this phase the exchange interaction breaks graphene's spin-valley degeneracy. Here, Hu, Zhu, Li, Wang, and coauthors introduce scanning conductivity and chemical potential microscopy and use this technique to map the quantum Hall phase diagram.
Jiawei Hu, Shao Zhu & Hong-Jun Gao

Article
25 June 2026 | Open Access
High-performance topochemical polymerization-based photo-curing with sub-50 nm resolution utilizing visible light

Coating the large-area single-crystal films needed for photoinduced topochemical polymerization-based photolithography is a challenge. Here, the authors use benzimidazole-containing monomers to create such films, and apply them as photoresists for high-resolution photolithography using low-power lasers to achieve sub-50 nm resolutions.
Yonggang Ren, Zhenfeng Gu & Yilin Zhang

Article
25 June 2026 | Open Access
Dynamic roughening of cities driven by multiplicative noise

This study shows that cities grow upward through random, self-amplifying processes modulated by local interactions, linking urban form and economic growth to universal patterns from statistical physics.
Martin Hendrick & Gabriele Mancini

Article
25 June 2026 | Open Access
Mechanistic insights into modulation of productive substrate accessibility for efficient PET depolymerization

Polyethylene terephthalate (PET) hydrolysis has been extensively studied for their applications in plastic degradation, but the structural and mechanistic factors that limit their catalytic efficiency are not yet fully understood. Here, the authors identify the protruding, surface-exposed π -terminal loop (DCL-loop) in Copromegastigmum aculeatum (CMA) that negatively impacts enzymatic activity by restricting productive access of enzyme to PET substrates.
Dongmeo Ki, Jiyoung Park & Kyung-Jin Kim

Article
25 June 2026 | Open Access
Synthesis of alumina ceramic meta-fibers with tensile super-plasticity

Here, authors help to address both strength and toughness in ceramics by making plastic Al₂O₃ meta-fibers, with tensile strength of 1.94 GPa and plastic strain of 10%. They can be further woven into textiles.
Jiwei Wu, Yonghui Guo & Jianhua Yan

Article
25 June 2026 | Open Access
Catalytic Enantioselective Construction of Planar Chiral Heterocyclic 1,2-Paracyclophanes Enabled by Copper-Catalyzed Desymmetric Azide-Alkyne Cycloaddition

Catalytic asymmetric approaches to access valuable heterocyclic 1,2-Paracyclophanes directly remain underexplored. Herein, the authors present the enantioselective synthesis of planar chiral triazole-based 1,2-Paracyclophanes via a desymmetrizing copper-catalyzed alkyne-azide cycloaddition reaction.
Zhuang Zhuang Li, Yuan-Mei Feng & Kai-Feng Zhang

Article
25 June 2026 | Open Access
Solution-processed aqueous insensitive transparent conductors for bio-optoelectronics

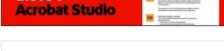
Long-term operation of bio-optoelectronics requires stable conductors for biological environments. Here, the authors develop a solution-processed transparent conductors that resist water-rich environments, enabling stable electrical recording and optical imaging on skin and brain surfaces.
Lida Sun, Hyon Woo Kim & Jaesoo Sonemaya

Article
25 June 2026 | Open Access
Second-level fast interline enables high-brightness light source for visible light communication

This study reports a rapid interline technique with machine-learning-guided design to fabricate photonic ceramics within only 10 s. Such ceramics show excellent performance in the laser-driven light sources for visible light communication.
Georgios Wang, Wei Xiong & Hong-Jun Xie

Article
25 June 2026 | Open Access
Surface energy-driven perpendicular gradient structure in flexible composite dielectrics for high-temperature capacitive energy storage

The authors design a perpendicular gradient structured polymer composite dielectric with an inorganic hybrid crosslinking network of SiO₂-TiO₂. This unique architecture enables an energy density of 4.04 kJ/cm³ with an efficiency of 90% at 200 °C.
Miaoan Yang, Huanan Yan & Zhi-Min Dang



Browse narrower subjects

- Astronomy and planetary science
- Chemistry
- Energy science and materials
- Engineering
- Mathematics and computing
- Nanoscience and technology
- Optics and photonics
- Physics

Browse Physical Sciences across other nature.com journals >>