

Physical sciences articles within *Nature Communications*

## Featured

Article

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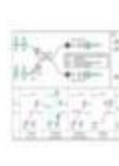
**Three-dimensional flexible thermoelectric fabrics for smart wearables**

Wearable thermoelectric devices are promising, though fabricating a breathable, sensitive, and washable devices has been a challenge. This report shows a woven thermoelectric fabric, incorporating rigid and flexible layers, for smart wearable devices.

Xinyang He, Xiao-Lei Shi &amp; Zhi-Gang Chen

Article

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**Chiral europium halides with high-performance magnetic field tunable red circularly polarized luminescence at room temperature**

Chiral organic-inorganic perovskites are promising materials for circularly polarized luminescence. Here the authors present chiral europium halides leading to red circularly polarized luminescence with large dissymmetry factor and strong magneto-chiroptical properties.

Xinyi Niu, Yang Li &amp; Guanxui Long

Article

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**High-fidelity remote entanglement of trapped atoms mediated by time-bin photons**

In this paper, the authors show high-fidelity entanglement of 97% between remote trapped ion memories, mediated by time-bin photons. The time-bin nature of photons removes polarization errors and allows extension to higher dimensional qubit memories.

Sagnik Saha, Mikhail Shalaev &amp; Christopher Monroe

Article

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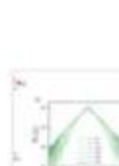
**Solar-powered light-modulated microwave programmable metasurface for sustainable wireless communications**

Achieving sustainability in wireless communications is crucial yet poses significant challenges. To address this, the authors propose and demonstrate a solar-powered programmable metasurface enabling hybrid light-to-microwave wireless communications.

Han Wei Tian, Ya Lun Sun &amp; Wei Xiang Jiang

Article

13 March 2025 | Open Access

**Controlled chain-growth polymerization via propargyl/allenyl palladium intermediates**

In contrast to allyl palladium complexes, propargylic/allenyl palladium species display complex reactivities that limit their implementation in polymer chemistry. Here, the authors report an example of controlled chain-growth polymerization via propargyl/allenyl palladium intermediates.

Zheng-Lin Wang &amp; Rong Zhu

Article

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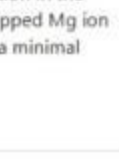
**Observation of quantum criticality of a four-dimensional phase transition**

Contrarily to most phase transition paradigms, the Anderson localization-delocalization phase transition in disordered systems exhibits highly nontrivial criticality in higher dimensions. Here the authors characterize the Anderson transition in an ultracold gas with both disorder and three synthetic dimensions engineered by means of periodic driving.

Farid Madani, Maxime Denis &amp; Radu Chircireanu

Article

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**Dissipative charge transport in organic mixed ionic-electronic conductor channels**

The authors examine the signal propagation and energy dissipation in organic mixed ionic-electronic conductor channels. Results highlight intrinsic limitations of organic bioelectronic circuits and compare their efficiency to neuronal signal transmission.

Filippo Bonafè, Mattia Bazzani &amp; Tobias Cramer

Article

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**Self-assembly, interlocking, interconversion and anion-binding catalysis in phenoxazine-based Pd<sub>2</sub>L<sub>4</sub> and Pd<sub>4</sub>L<sub>8</sub> coordination cages**

While Pd<sub>2</sub>L<sub>4</sub>-type coordination cages tend to form interlocked dimers, isolation and characterization of both the cage and its interlocked dimer is very challenging. Herein, the authors report the synthesis and solvent-mediated interconversion of highly soluble phenoxazine-based monomeric cage and corresponding interlocked dimer.

Qiong-Yan Hong, Bin Huang &amp; Xueliang Shi

Article

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**Inorganic-organic hybrid cobalt spinel oxides for catalyzing the oxygen evolution reaction**

Unlocking the potential of traditional nanomaterials like spinel oxides is crucial for improving the catalytic oxygen evolution reaction. Here, the authors report an inorganic-organic hybrid spinel oxide that enhances both catalytic activity and structural stability through a coordination method.

Shuowen Bo, Xiuxiu Zhang &amp; Qinghua Liu

Article

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**Pyrrolidine synthesis via ring contraction of pyridines**

Ring contraction of easily available cyclic compounds to smaller cycles that are valuable but difficult to synthetically access is an important skeletal editing strategy. Here, the authors report a photo-promoted ring contraction of pyridines with silylborane to afford pyrrolidine derivatives bearing a 2-azabicyclo[3.1.0]hex-3-ene skeleton.

Ryoga Ueno, Shohel Hirano &amp; Jun Takaya

Article

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**Wafer-scale platform for on-chip 3D radio frequency lumped passive components using metal self-rolled-up membrane technique**

A wafer-scale self-rolled-up membrane platform is developed for radio-frequency on-chip passive components like inductors and capacitors on a 4-inch sapphire wafer. The authors demonstrate compact metal self-rolled-up membrane inductors with improved inductance and higher quality factor achieved by post-electroplating.

Zhikun Zhou, Zihan Zhang &amp; Wen Huang

Article

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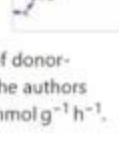
**Pickering emulsions with low interface coverage but enhanced stability for emulsion interface catalysis and SERS-based detection**

Particle adsorption at the oil-water interface is an important strategy for emulsion stabilization against coalescence but achieving free interfaces at the same time remains challenging. Here the authors report an emulsion with low droplet surface coverage but enhanced stability by employing colloidal rings as emulsifiers.

Mingkun Li, Qing Song &amp; Bing Liu

Article

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**Copper-catalysed dynamic kinetic asymmetric C–O cross-coupling to access chiral aryl oxime ethers and diaryl ethers**

The dynamic kinetic asymmetric C–O cross-coupling has presented significant challenges and remains unexplored. Here, the authors report the dynamic kinetic asymmetric C–O cross-coupling of oximes and phenols via copper/BOK-catalysed enantioselective O-arylation with diaryliodonium salts.

Mei-Ru Zhang, Hao-Ran Wang &amp; Ren-Rong Liu

Article

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**Understanding capacity fading from structural degradation in Prussian blue analogues for wide-temperature sodium-ion cylindrical battery**

Low-cost Fe-based Prussian blue analogues often suffer from capacity fading, impeding commercialization for practical sodium-ion batteries. Here, authors study the origins of Prussian blue analogues cathode degradation and applied regulation of coordination environment and crystal nucleation growth in cylindrical cells.

Hang Zhang, Jiaqiang Li &amp; Shu-Lei Chou

Article

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**Sustainable bioactive hydrogels for organic contaminant elimination in wastewater**

Use of immobilized enzymes in bioremediation has potential in water treatment, but limited enzymatic activity and stability can cause issues. Here, the authors report the development of a strategy to immobilize enzymes within a hydrogel while maintaining good activity against a range of pollutants.

Jinlong Zhang, Jason C. White &amp; Xilong Wang

Article

12 March 2025 | Open Access

**Photo-induced ring-maintaining hydrosilylation of unactivated alkenes with hydrosilycyclobutanes**

Silacyclobutanes have wide applications in ring opening and ring extension reactions, but functionalization remains challenging. Herein, the authors report visible-light-induced metal-free hydrosilylation of unactivated alkenes with hydrosilycyclobutanes.

Shaowei Chen, Meiyun Gao &amp; Xiao Shen

Article

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**Solvent-free processing of lignin into robust room temperature phosphorescent materials**

Preparing room temperature phosphorescent materials from biomass is important but challenging. Here, the authors report the use of liquid monomer 2-hydroxyethyl acrylate for dissolution of lignin and subsequent solvent-free preparation of lignin-based RTP materials.

Min Wang, Wei-Ming Yin &amp; Zhijun Chen

Article

12 March 2025 | Open Access

**Ground-state charge transfer in single-molecule junctions covalent organic frameworks for boosting photocatalytic hydrogen evolution**

Ground state charge transfer is important for improving the photocatalytic performance of donor-acceptor type covalent organic frameworks (COFs), but it has been underexplored. Here, the authors report a COF with enhanced charge transfer, achieving a hydrogen evolution rate of 265 mmol g<sup>-1</sup> h<sup>-1</sup>.

Rongchen Shen, Can Huang &amp; Xin Li

Article

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**Bioinspired gel polymer electrolyte for wide-temperature lithium metal battery**

Lithium-metal batteries struggle in extreme environments, restricting their applications. Here, authors report a bioinspired gel polymer electrolyte that employs double dipole coupling to form a weak solvation structure, enabling stable operation of lithium-metal batteries from -30 to 80 °C.

Shuochan Liu, Wensheng Tian &amp; Shenmin Zhu

Article

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**Orbital angular momentum control of strong-field ionization in atoms and molecules**

Ionization of atoms and molecules is a ubiquitous phenomenon at the core of attosecond science, plasma, and strong-field physics. Here, the authors demonstrate that the orbital angular momentum of laser beams can be used to selectively control photoionization via asymmetrically displaced Laguerre-Gaussian beams, shedding light on the subtle role of spatial inhomogeneities.

Jean-Luc Béglin, Ebrahim Karimi &amp; Ravi Bhardwaj

Article

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**Nonlinear dynamics and magneto-elasticity of nanodrums near the phase transition**

Magnetic phase transitions typically lead to changes in a materials magnetostrictive properties. Here, Siskins et al use the motion of a nanodrum to study the nonlinear magneto-mechanical response of FePS<sub>2</sub>, and observe changes in the nonlinear stiffness and damping near the Néel temperature.

Makars Šiskins, Ata Keşkekler &amp; Farbod Aljani

Article

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**Machine learning-driven molecular dynamics unveils a bulk phase transformation driving ammonia synthesis on barium hydride**

The traditional view of industrial heterogeneous catalysis is shifting from a static to a dynamic paradigm. Here, the authors show that BaH<sub>2</sub> does not merely serve as static platform for reactions during ammonia synthesis, but rather it is a dynamic entity that evolves under reaction conditions.

Azel Tosello Gardini, Umberto Raucci &amp; Michele Parrinello

Article

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**Highly efficient ionic actuators enabled by sliding ring molecule actuation**

Traditional actuation mechanism for ionic actuators suffers from low energy transduction efficiency. Here, the authors report a sliding ring actuation mechanism for ionic actuators with high energy transduction efficiency and large energy density.

Chao Lu, Wei Chen &amp; Xiaohong Zhang

Article

12 March 2025 | Open Access

**Cyano-functionalized polyethylenes from ethylene/acrylamide copolymerization**

Synthesizing functionalized polyethylenes via ethylene coordination copolymerization using vinyl polar monomers is challenging. Here, the authors present an approach utilizing binuclear Ni catalysis for ethylene/acrylamide copolymerization to synthesize cyano-functionalized polyethylenes.

Shu-Yang Yu, Xiao-Yan Wang &amp; Yong Tang

Article

12 March 2025 | Open Access

**Hydrogen-bonded organic frameworks for photocatalytic synthesis of hydrogen peroxide**

A series of hydrogen-bonded frameworks were developed for photocatalytic H<sub>2</sub>O<sub>2</sub> production. These materials are shown to facilitate charge separation and transfer and optimize the reaction pathway toward H<sub>2</sub>O<sub>2</sub>.

Ji-Hong Zhang, Zhao-Ming Ge &amp; Tong-Bu Lu