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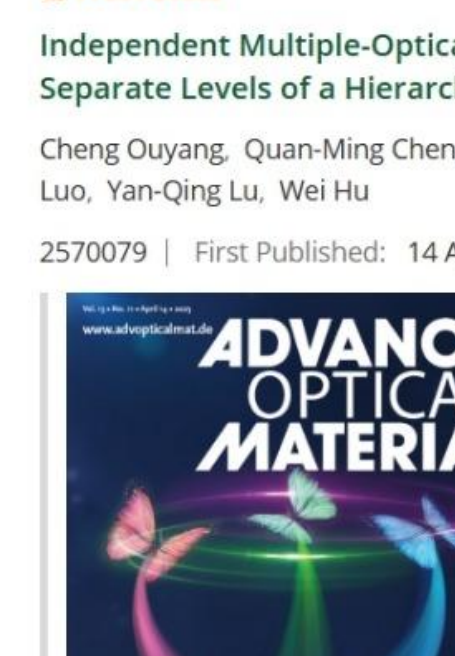
Independent Multiple-Optical-Parameter Modulations Enabled by Manipulating the Separate Levels of a Hierarchical Structure (Advanced Optical Materials 11/2025)

Cheng Ouyang, Quan-Ming Chen, Zhi-Yao Xie, Chun-Ting Xu, Qi-Guang Wang, Zhi-Gang Zheng, Dan Luo, Yan-Qing Lu, Wei Hu

2570079 | First Published: 14 April 2025



Optical Informatics

The separate control of multiple degrees of light has great significance in the optical informatics. This work presents the independent modulations of the amplitude, wavelength, and phase of light via manipulating the hierarchical structures of blue phase liquid crystals. More details can be found in article 2402844 by Wei Hu and co-workers.

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Inside Front Cover

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Deep Trap Management in Organic Persistent Luminescence for Multi-Mode Optical Information Storage (Advanced Optical Materials 11/2025)

Cunjian Lin, Rujun Yang, Yang Li, Chenhan Zhan, Yajing Wang, Zixuan Zhang, Zishuang Wu, Da Xiong, Wenting Deng, Shihai You, Ying Lv, Yixi Zhuang, Rong-Jun Xie, Jumpei Ueda

2570080 | First Published: 14 April 2025

Organic Persistent Luminescence

The D-A-D wedge-shaped TADF emitter TCN, incorporating a strong electron-accepting segment, serves as the guest, while the electron-transporting molecule TPBi acts as the host in an organic deep-trap-induced persistent luminescence system. This design enables multi-mode excitation (UV light, visible light, and X-ray) and stimulation (NIR light and heating), extending the applications of persistent luminescence media to blue-laser writing, X-ray imaging, and NIR signatures. More details can be found in article 2402301 by Jumpei Ueda and co-workers.

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Polarization-Sensitive Subwavelength Nanopixel for On-Off and Color Switchable Color Printing (Advanced Optical Materials 11/2025)

Hyerin Song, Heesang Ahn, Kyujung Kim

2570081 | First Published: 14 April 2025

Nanopixel for Color Conversion and On-Off Switching

In article 2402032, Kyujung Kim and co-workers present a polarization-sensitive dual nanodisk nanopixel, enabling precise color modulation and on-off switching. By adjusting plasmonic coupling through dielectric gaps and the polarization direction, it achieves significant control over wavelength shifts and light intensity, paving the way for innovative applications in optical devices, sensors, and data encryption.

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2570082 | First Published: 14 April 2025

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Perspective

Open Access

Building Scalable Silicon Microring Resonator-Based Neuromorphic Photonic Circuits Using Post-Fabrication Processing with Photochromic Material

Lei Xu, Jiawei Zhang, Eli A. Doris, Simon Bilodeau, Jesse A. Wisch, Manting Gui, Yusuf O. Jimoh, Bhavin Shastri, Barry P. Rand, Paul R. Prucnal

2402706 | First Published: 20 March 2025

One of the high-impact research goals in neuromorphic photonics is to build scalable photonic artificial intelligence computing at high energy efficiency. This perspective paper discusses microring resonator (MRR)-based large-scale photonic neural networks, variations of MRR resonance wavelength from fabrication, and post-fabrication processing with photochromic materials to compensate MRR characteristics variations, leading to scalability and significant energy savings.

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Review

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Ambient-Air-Processed, Solution-Based Organic Photovoltaics and Photodetectors

Bahareh Nasrollahi, Javith Mohammed Jailani, Jacob Loftus, Vincenzo Pecunia

2403085 | First Published: 29 January 2025

This review explores ambient-air-processed, solution-based organic photovoltaics (OPVs) and organic photodetectors (OPDs). It highlights advancements in photoactive materials, charge transport layers, and electrodes integrated into devices processed in ambient air via solution-based methods, examining their performance, stability, and scalability, and discussing remaining challenges. The paper offers valuable insights for scaling up low-cost organic optoelectronics for energy harvesting and sensing applications.

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Exciton Dynamics in 2D Transition Metal Dichalcogenides

Jingang Li, Rundi Yang, Runxuan Li, Costas P. Grigoropoulos

2403137 | First Published: 20 February 2025

2D transition metal dichalcogenides (TMDCs) have emerged as a promising class of materials with their physical properties dominated by strong excitonic effects. This review summarizes the current state of research on exciton dynamics in TMDCs, discusses common optical characterization techniques, and analyzes factors that influence exciton behaviors, such as thickness, dielectric environment, strain, and heterostructure configuration.

Abstract | Full text | PDF | References | Request permissions

Research Article

Independent Multiple-Optical-Parameter Modulations Enabled by Manipulating the Separate Levels of a Hierarchical Structure

Cheng Ouyang, Quan-Ming Chen, Zhi-Yao Xie, Chun-Ting Xu, Qi-Guang Wang, Zhi-Gang Zheng, Dan Luo, Yan-Qing Lu, Wei Hu

2402844 | First Published: 30 December 2024

This work demonstrates the dynamic and independent modulations of the reflectance, wavelength, and geometric phase of light based on manipulating the hierarchical structure of a blue-phase liquid crystal under different stimuli. It unlocks the multi-degree modulation of light and may dramatically upgrade the performance of existing optics.

Abstract | Full text | PDF | References | Request permissions

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Deep Trap Management in Organic Persistent Luminescence for Multi-Mode Optical Information Storage

Cunjian Lin, Rujun Yang, Yang Li, Chenhan Zhan, Yajing Wang, Zixuan Zhang, Zishuang Wu, Da Xiong, Wenting Deng, Shihai You, Ying Lv, Yixi Zhuang, Rong-Jun Xie, Jumpei Ueda

2402301 | First Published: 24 January 2025

The D-A-D wedge-shaped TADF emitter TCN, featuring a strong electron-accepting segment, is employed as the guest of an organic trap-induced persistent luminescence system, enabling multi-mode excitation, and stimulation forms, deep trap, low aggregation-induced quenching effect, and high thermal stability. This extends PersL media applications to blue-laser writing, X-ray imaging, and NIR signatures.

Abstract | Full text | PDF | References | Request permissions

Polarization-Sensitive Subwavelength Nanopixel for On-Off and Color Switchable Color Printing

Hyerin Song, Heesang Ahn, Kyujung Kim

2402032 | First Published: 08 January 2025

This study introduces a novel polarization-sensitive dual nanodisk nanopixel, enabling precise color modulation and on-off switching. By adjusting plasmonic coupling through dielectric gaps and polarization direction, it achieves significant control over wavelength shifts and light intensity, paving the way for innovative applications in optical devices, sensors and data encryption.

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Exciton Diffusion in Two-dimentional Chiral Perovskites

Sophia Terres, Lucas Scalon, Julius Brunner, Dominik Horneber, Johannes Düreth, Shiyu Huang, Takashi Taniguchi, Kenji Watanabe, Ana Flávia Nogueira, Sven Höfling, Sebastian Klembt, Yana Vaynzof, Alexey Chernikov

2402606 | First Published: 28 March 2025

Transport of light-emitting excitons is demonstrated in 2D chiral perovskites via transient optical microscopy. The excitons are found to diffuse rapidly after the excitation followed by localization at longer time-scales. Temperature-dependent exciton propagation combined with photothermal deflection spectroscopy measurements reveal the role of disorder and an unusually strong effect of density activated diffusion is reported.

Abstract | Full text | PDF | References | Request permissions

Immobilization of Mie-Resonant Silicon Nanospheres on a Silica Substrate for Surface-Enhanced Fluorescence

Oanh Vu, Keisuke Ozawa, Mojtaba Karimi Habil, Hiroshi Sugimoto, Minoru Fujii

2402808 | First Published: 22 March 2025

A large area surface-enhanced fluorescence substrate made of a monolayer of silicon nanospheres immobilized on a silica substrate is produced by a wet chemical process from a colloidal suspension of size-purified crystalline silicon nanospheres having the Mie resonances in the visible to near infrared range.

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Fluorescent-Enhanced Radiative Cooling of Colored Cellulose Pulp for Thermal Management and Aesthetic Applications

Qilong Cheng, Wenhui Xu, Zhenyuan Niu, Tian Li

2402827 | First Published: 28 March 2025

This work introduces a transformative approach to engineering colored cellulose pulp with fluorescence, unlocking advanced thermal management and vibrant aesthetics. By combining multiscale porosity and photoluminescence effects, the study demonstrates significant cooling performance under sunlight. Comprehensive characterization, simulations, and field tests validate the method's scalability and industrial potential, paving the way for sustainable, high-value applications across diverse industries.

Abstract | Full text | PDF | References | Request permissions

Achieving Ultralong Red Afterglow Emission in Mn^{2+}-Doped NH_4CdCl_3 Hybrid Perovskite Through Trap State Modulation

Guanfeng Liu, Shuai Zhang, Yaoyu Liu, Fanghao Xuan, Bing Teng, Shaohua Ji

2402858 | First Published: 25 March 2025

Organic–inorganic hybrid perovskites usually show short afterglow time due to phosphorescence. This study introduces defect states into the hybrid perovskite NH_4CdCl_3 through a doping strategy, achieving an ultralong red afterglow of up to 2400 s that is independent of triplet exciton phosphorescence. This approach provides a new strategy to improve the afterglow duration in hybrid perovskites.

Abstract | Full text | PDF | References | Request permissions

The Optical Encoder Based on Mechanoluminescent Materials and Application in Dual-Key Encryption

Yun Liu, Junwen Yu, Quanwang Niu, Xiangfu Wang

2403010 | First Published: 29 January 2025

This study proposes an optical encoder based on the porous structure mechanoluminescent materials and a dual-key encryption system inspired by *Ba-Gua*. By converting mechanical stress into dual-color light and trigram information, the system enables dynamic, rewritable hybrid encoding for numerical and Chinese characters, offering new directions for secure information concealment and multidimensional encryption applications.

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Regulation of Perovskite Nucleation and Orientated Crystal Growth via In Situ Self-Crosslinking Polymer for Bright Perovskite Light-Emitting Diodes

Suwen Cheng, Yupeng Zhang, Ying Chu, Yanchen Wang, Yuan Xie, Chen Yu, Jingjin Dong, Jiupeng Cao, Fangfang Wang, Wei Huang, Aifei Wang, Tianshi Qin

2403012 | First Published: 28 January 2025

Thermally polymerized additive N-vinyl-2-pyrrolidone (NVP) can prolonging the perovskite crystallization process, separating the nucleation and crystal growth by forming an NVP-precursor intermediate phase. Additionally, the intermediate adduct effectively passivates defects, reduces nonradiative recombination, improves crystallinity, and enhances the transmission of charge carriers.

Abstract | Full text | PDF | References | Request permissions

One-Step Creation of Quantum Emitter Arrays in Hexagonal Boron Nitride by Local Stress Application

Sofiya Karankova, Yeunjeong Lee, Chaun Jang, Yong-Won Song, Hyowon Moon

2403018 | First Published: 26 December 2024

Generation of quantum emitters (QEs) in hexagonal boron nitride is demonstrated using localized stress application without any complicated pre- or post-processes, such as lithography or annealing. This one-step method achieves site-specific QE generation with a yield of over 70% for all emitter arrays. QEs exhibit zero-phonon line consistency within a narrow wavelength range, with an average value of ≈595 nm.

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Tuning 1D Plasmonic Gap at Nanometer Scale for Advanced SERS Detection

Mahsa Haddadi Moghaddam, Sobhagyam Sharma, Daehwan Park, Dai Sik Kim

2403021 | First Published: 17 January 2025

Hotspots in nanogaps play a crucial role in enhancing surface-enhanced Raman scattering (SERS), a highly sensitive technique for detecting molecules. Thermally tunable nanogaps are developed on flexible substrates that allow precise control of gap size to accommodate molecules of different sizes and uniform fabrication over large areas. These innovations significantly improve SERS signals and provide a versatile tool for broad applications in sensing and analysis.

Abstract | Full text | PDF | References | Request permissions

Dispersion of Ultrafast Nonlinear Shift Current in SnTe Revealed by Photon-Energy-Dependent Terahertz Emission Spectroscopy

Zeyun Wang, Fan Wang, Guorong Xu, Xueqin Cao, Yayan Xi, Yuanyuan Huang, Xinlong Xu

2403030 | First Published: 12 February 2025

Photon-energy-dependent THz emission spectroscopy induced by ultrafast shift current in SnTe under the above-bandgap (E_g) excitation. The dispersion relationship across the visible to near-infrared region shows that THz amplitude evolution contains notable enhancement at E_g and near $2E_g$, which can be well described by a classical anharmonic oscillator model phenomenologically.

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Silane Network Passivation Through Lead-Sulfur Interaction of X-Type Thiol-Group Ligands for Polar-Resistance and Improved Mobility in Perovskite Quantum Dots

Jin Young Kim, Jihyun Lim, Woongsik Jang, Dong Hwan Wang

2403039 | First Published: 27 February 2025

The addition of 3-mercaptopropyltrimethoxysilane to the synthesized $CsPbBr_3$ perovskite quantum dots formed Pb-S interactions, enhancing the interstructural binding energy and exhibiting strong resistance to polar solvents. The passivation of the silane network on the surface exhibited surface properties, with strong electron mobility and low trap site distribution.

Abstract | Full text | PDF | References | Request permissions

$(C_6H_5N_2)HgCl_3$: Discovery of a Polar Hg-Based Hybrid Halide as Preeminent Nonlinear Optical and Birefringent Material Activated by π-Conjugated Organic Cation Substitution

Ru-Ling Tang, Die-Xue Yang, Liang Ma, Yi-Lei Lv, Wenlong Liu, Sheng-Ping Guo

2403044 | First Published: 30 December 2024

A Hg-based hybrid halide, $(C_6H_5N_2)HgCl_3$, shows excellent birefringence (0.36@546nm), which is greater than those of all inorganic metal halide birefringent crystals. $(C_6H_5N_2)HgCl_3$ also has a strong SHG effect (3.04 × KDP) and is the strongest among mercury-hybrid halides.

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Interfacially Weakened Förster Resonance Energy Transfer of Biocompatible Hole Transport Layers for Enhanced Perovskite Light-Emitting Diodes

Yuqiang Huang, Qungui Wang, Maolin Mu, Lunyao Pan, Peng Song, Arslan Ahme Drafi, Weiqing Yang, Yuanzuo Li

2403055 | First Published: 12 February 2025

Using sodium copper chlorophyllin with "single-point configuration" to replace chlorophyll as the hole transport layer (HTL) of the perovskite light-emitting diodes can effectively weaken the electrostatic anchoring effect at the HTL/perovskite interface. This weakening of the anchoring effect successfully suppresses the Förster resonance energy transfer at the interface, resulting in a significant increase in external quantum efficiency and luminance.

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Tailoring Chain-Length in Through-Space Charge-Transfer Donor-σ-Acceptor Multifunctional Emitters for Efficient Long-Term Bioimaging

Tapashi Sarmah, Soumik Pal, Debasish Barman, Debika Barman, Bithiah Grace Jaganathan, Parameswar Krishnan Iyer

2403060 | First Published: 28 January 2025

Four adjustable through-space charge-transfer luminogens having a unique acceptor moiety and even–odd alkyl chain modulated D-σ-A are synthesized that exhibit a rare coexistence of AIE, TADF, AIDF, ML, and MC properties simultaneously. They has the unusual odd-even effect of the alkyl chain on their photophysical behavior, low ΔE_{ST} values of (0.03–0.0003 eV), high lifetimes of 56–344 µs, 36–85% total quantum efficiency and utilized for prolonged bioimaging and unusual internalization mechanism of breast cancer cells.

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Spin Valley Dynamics Entangled with Optical Fields, Phonons, and Spin-Orbit Coupling in Monolayer $MoSe_2$

Linjie Chen, Zhi Li, Qunxiang Li, Qijing Zheng, Jin Zhao

2403069 | First Published: 06 February 2025

Hefei-NAMD framework is advanced by introducing light–matter interactions, enabling comprehensive simulations of the carrier dynamics in solid materials from photoexcitation to relaxation.

Abstract | Full text | PDF | References | Request permissions

Triplet Energy Transfer and Photon Upconversion from Metal Nanocluster with Near-Unity NIR Emission Quantum Yield

Linlin Zeng, Wan-Qi Shi, Jie Kong, Wei Zhang, Quan-Ming Wang, Yi Luo, Meng Zhou

2402991 | First Published: 29 November 2024

Efficient triplet energy transfer (TET) from $Au_{16}Cu_6$ nanoclusters, which exhibit near-unity photoluminescence quantum yield, to various organic molecules is reported. The highest TET efficiency is observed in perylene. A triplet-triplet annihilation upconversion (TTA UC) system is developed using $Au_{16}Cu_6$ as the sensitizer and perylene as the annihilator, achieving an upconversion quantum yield of up to 13.1%.

Abstract | Full text | PDF | References | Request permissions

Eco-Friendly and Scalable Preparation of High-Efficiency Passive Daytime Radiative Cooling Film Based on Dual-Layer Strategy

Yingjie Wu, Bin Liu, Renyan Zhang, Yingeng Wang, Mingbo Pu, Xiong Li, Xiangang Luo

2403087 | First Published: 24 January 2025

A high-efficiency passive daytime radiative cooling (HE-PDRC) material based on a two-layer strategy has been prepared. It consists of a bottom layer filled with barium titanate (BTO) and a top layer filled with aluminum oxide (Al_2O_3) nanoparticles. The scattering efficiency curve of BTO nanoparticles is complementary to that of Al_2O_3 nanoparticles, coordinated to achieve scattering efficiency in the solar radiation band. Ultimately, the obtained HE-PDRC film exhibits superb solar reflectance (0.948) and infrared atmospheric window emissivity (0.964). Using a liquid material as the matrix for the film and fabricating it via scrape coating technology enables an eco-friendly and scalable preparation process.

Abstract | Full text | PDF | References | Request permissions

Metasurface-Enabled Cascaded Multispectral Polarization Structures Along the Longitudinal Direction

Yan Li, Qunxing Yu, Shuaifu Zhao, Quan Yuan, Facheng Zhong, Xianzhong Chen, Shuming Wang

2403093 | First Published: 30 December 2024

Understanding fundamental optics relies heavily on both polarization and color. Here, a metalens approach is proposed to create multiple cascaded multispectral polarization numbers (letters) at predesigned planes along the longitudinal direction. The approach integrates two-dimentional (2D) polarization generation, multiple colors, longitudinal control, and cascading design, offering extra degrees of freedom for customized polarization design with extensive potential applications.

Abstract | Full text | PDF | References | Request permissions

Revealing the Effect of Triplet–Triplet Annihilation Up-Conversion and Improving the Operational Lifetime by Exciton Management in Anthracene- and Pyrene-Based Blue Fluorescent OLEDs

Jianhui Pan, Wei Liu, Lei Ying, Yue Yu, Xianfeng Qiao, Dezhi Yang, Yuguang Ma, Dongge Ma

2403102 | First Published: 10 March 2025

TTA process is responsible for device stability. A higher TTA quenching constant means poorer stability and a faster defect generation rate. The defects will quench the triplet excitons without affecting carriers in PAC-based device, while they will act as trapping carriers in CPPCN-based device, leading to a continuous increase in V_{bi}.

Abstract | Full text | PDF | References | Request permissions

Discovery of a Resonant High-Level Reverse Intersystem Crossing of Hot Exciton from Conventional TTPA Fluorescent Semiconductor and an Attempt on High-Efficiency TTPA-Based OLEDs

Junhong Liu, Jing Chen, Jingjing Wang, Teng Peng, Bo Wang, Yinqiong Zhou, Keyi Zhang, Jun Yang, Feng Chen, Yuanjun Li, Qiang Li, Jinfeng Guo, Xiaoli Chen, Zuhong Xiong

2403105 | First Published: 17 February 2025

Using the fingerprint magneto-electroluminescence (MEL) trace as an effective probing tool, this work discovers a resonant high-level reverse intersystem-crossing (HL-RISC, $S_{1,\ TTPA} \leftarrow T_{2,\ TTPA}$) of hot-excitons from the conventional green fluorescent semiconductor of 9,10-bis[N,N-di-(p-tolyl)-amino]anthracene (TTPA). More importantly, fully fluorescent OLEDs based the simple emissive layers of pure TTPA and TTPA-doped DMAC-DPS films present EQEs of 4.32% and 10.14%, respectively.

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Improved Laser Performance of Carbon-Bridged Oligo(p-phenylenevinylene)s Through σ-π Conjugation with Silyl Groups

Álex Farrando-Pérez, Yuiko Hattori, Angela Martínez, Kaito Sasaki, Shuto Nunobiki, José M. Villalvilla, Pedro G. Boj, José A. Quintana, Hayato Tsuji, María A. Díaz-García

2403118 | First Published: 13 February 2025

Shorter blue-emitting carbon-bridged oligo(p-phenylenevinylene)s (COPV*m*, *m* = 1,2) encounter challenges with photostability and high lasing thresholds. This study demonstrates the effectiveness of σ-π conjugation to improve these properties, through functionalization of COPV2 with terminal silyl group ($COPV2–Si_1$ and $COPV2–Si_2$). Both compounds exhibit amplified spontaneous emission ≈480 nm, with $COPV2–Si_2$ showing a lower threshold and extended durability, indicating strong potential for laser applications.

Abstract | Full text | PDF | References | Request permissions

Impact of Halogen Groups on the Properties of PEA-Based 2D Pb–Sn Halide Perovskites

Elham Foadian, Sheryl L Sanchez, Sumner B. Harris, Benjamin J. Lawrie, Astita Dubey, Yipeng Tang, Bin Hu, Jonghee Yang, Mahshid Ahmadi

2403120 | First Published: 08 January 2025

This study presents an exploration of halogenated spacer cations in mixed Pb–Sn halide perovskites using a high-throughput experimental setup. By systematically varying compositions in synthesized films and employing advanced characterization techniques, it demonstrates how fluorination of spacer cations narrows broadband emission, reduces defects, and suppresses phase segregation, leading to improved optical and structural properties in Pb–Sn 2D halide perovskites.

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High-Performance Self-Driven $MAPbI_3$-$MAPbBr_3$ Perovskite Single Crystal Heterojunction Photodetectors for Ultra-Sensitive Weak Light Imaging

Chenyang Liu, Rui Wang, Jialin Liu, Wenli Xu, He Zhang, Xinying Liu, Xiangyu Huo, Xueying Cui, Haiqing Sun, Rui Liu, Huiling Zhu, Weiwei Zhang, Jianxu Ding

2403123 | First Published: 06 February 2025

$MAPbI_3$-$MAPbBr_3$ perovskite single crystal heterojunctions, formed via liquid phase epitaxy with polydimethylsiloxane as a substrate protector, demonstrate atomic force bonding. The heterojunction planar photodetector, without any transport layers, assesses incident light position and achieves low-light imaging with an on-off ratio of 5.8×10^4 and a detection rate of 4.5×10^{13} Jones in self-driven mode.

Abstract | Full text | PDF | References | Request permissions

Anomalous Ultra-Broadband Photoresponse Based on $PdSe_2$ with Asymmetric Contact

Mingli Liu, Wanqian Wang, Xuemin Zhang, Hongxiang Shi, SuoFu Wang, Tao Han, Feng Li, Lixing Kang, Wei Luo, Lei Shan, Mingsheng Long

2403065 | First Published: 24 January 2025

A vertical asymmetric contact photodetector with negative photoconductance is demonstrated. The anomalous photoresponse is observed in an ultrabroad spectral band from 637 nm to 10.6 µm. The device exhibits excellent uncooled long-wave infrared detection ability with a competitive responsivity of 38.2 AW^{-1}. This finds offers an new platform to study anomalous photoresponse.

Abstract | Full text | PDF | References | Request permissions

Deep Learning-Assisted Electro-Thermochromic Fluorescent Fibers for Self-Adaptive Intelligent Display in Dynamic Environments

Zixi Hu, Luyao Zhan, Yingying Zhang, Luping Sun, Xingchi Wang, Yongkun Liu, Haitao Ma, Mei Wang, Bin Ding, Ying Ma, Jianyong Yu

2403126 | First Published: 24 January 2025

The concept of a self-adaptive intelligent display controlled by deep learning is proposed by a wearable textile display system as an example implementation based on "off–on" electro-thermochromic fluorescent fibers. This self-adaptive intelligent textile display system unifies a deep learning technique and smart textile displays, offering new opportunities for next-generation wearable electronic systems.

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Laser In Situ Synthesis of Wide Bandgap Tunable Perovskite and Its Application in Micro-LEDs

Rongrong Xu, Qianxi Yin, Junyi You, Xiaoting Wang, Mulin Li, Xianliang Huang, Jun Chen, Haibo Zeng

2403132 | First Published: 12 February 2025

This work presents a method for continuous-wave (CW) laser in situ synthesis of wide bandgap tunable perovskite, with an emission spectrum ranging from 475 to 667 nm. Additionally, a two-color integrated technology is proposed for multicolor patterned displays and the application of color conversion layers in micro-LEDs.

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Reservoir Computing with All-Optical Non-Fading Memory in a Self-Pulsing Microresonator Network

Alessio Lugnan, Stefano Biasi, Alessandro Foradori, Peter Bienstman, Lorenzo Pavesi

2403133 | First Published: 10 March 2025

A photonic reservoir computing architecture based on 64 coupled silicon microring resonators is used to achieve non-fading memory, demonstrating robust multi-timescale signal processing capabilities. The passive photonic network exhibits nonlinear dynamics and multistability, facilitating extended information retention exceeding tens of microseconds. Experimental validation confirms successful temporal inference for both discrete pulses and spike trains across various timescales.

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Design of Highly Selective and Sensitive Optical Sensor for Arsenic(III) Based on the Orientational Coupling Between L-Cysteine and Liquid Crystals

Hyein Kim, Yeongseon Choi, Kwang-Suk Oh, Jun-Hyung Im, Won-Sik Kim, Asmita Shah, Dharmendra Pratap Singh, Young-Ki Kim

2403136 | First Published: 24 January 2025

The understanding of competitive intermolecular interactions enables a simple and versatile liquid crystal system for the detection of arsenic(III) in water and the quantification of its concentration in a wide range from 1 ppb to 4 ppm within 2 min. This strategy guides the creation of low-cost, personalized sensors with high selectivity and sensitivity for toxic metals.

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Low Surface Recombination Velocity and Enhanced Photocarrier Dynamics in Bi_2O_2Se Nanosheets

Tae Gwan Park, Minsoo Kang, Eon-Taek Oh, Ayoung Ham, Kibum Kang, Fabian Rotermund

2403138 | First Published: 20 March 2025

Surface-dominated photocarrier dynamics of Bi_2O_2Se nanosheets, an emerging non-van der Waals 2D semiconductor, are investigated. Thickness-dependent ultrafast optical spectroscopy reveals a long bulk lifetime and a low surface recombination velocity (SRV). The exceptionally low SRV highlights Bi_2O_2Se as a promising candidate for efficient optoelectronic and photonic applications, maintaining low photocarrier loss even at the ultrathin limit.

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