東南大學圖書館
Southeast University Library

东图学术快报
Academic express of SEU LIB

前沿经典　学科热点

学术动态　工具助手

编者按：2021 年不仅是“十四五”的开局之年，也是两个百年目标交汇与转换之年。为了让我校师生快速了解国内外学术前沿、经典及热点，图书馆学科服务团队特开辟此栏目，利用 WOS/ESI/Incites、Scopus/SciVal 等权威数据库和分析工具筛选研究前沿，或跟踪重要学术网站获取最新学术动态，分专题进行编译报道。因学科专业所限，难免出错，敬请批评指正。同时，我们也面向全校师生征集关注的领域和专题。

本期推荐报道 Nature、Science 期刊上材料科学领域的最新论文。

CONTACT US

联系电话：025-52090336-817

办公地址：李文正图书馆 B401 室

编辑：刘丽娟

审核：陆　美

美国 Science(《科学》)、英国 Nature(《自然》)及美国 Cell(《细胞》)是国际公认的三大享有最高学术声誉的科技期刊，发表在这三大期刊上的论文简称 CNS 论文。本次精选 2021 年 5 月 Science 和 Nature 中的部分材料科学领域论文，详细情况如下。

材料科学 5 月 Science 论文

[1]Role of the ionic environment in enhancing the activity of reacting molecules in zeolite pores

离子环境在提高沸石孔反应分子活性中的作用

出版信息：Science, 28 MAY 2021, VOL 372, ISSUE 6545

作者：Niklas Pfriem, Peter H. Hintermeier, Sebastian Eckstein, et al.

第一作者单位：Department of Chemistry and Catalysis Research Center, Technical University of Munich, Lichtenbergstrasse 4, 85747 Garching, Germany.

全文链接：https://science.sciencemag.org/content/372/6545/952

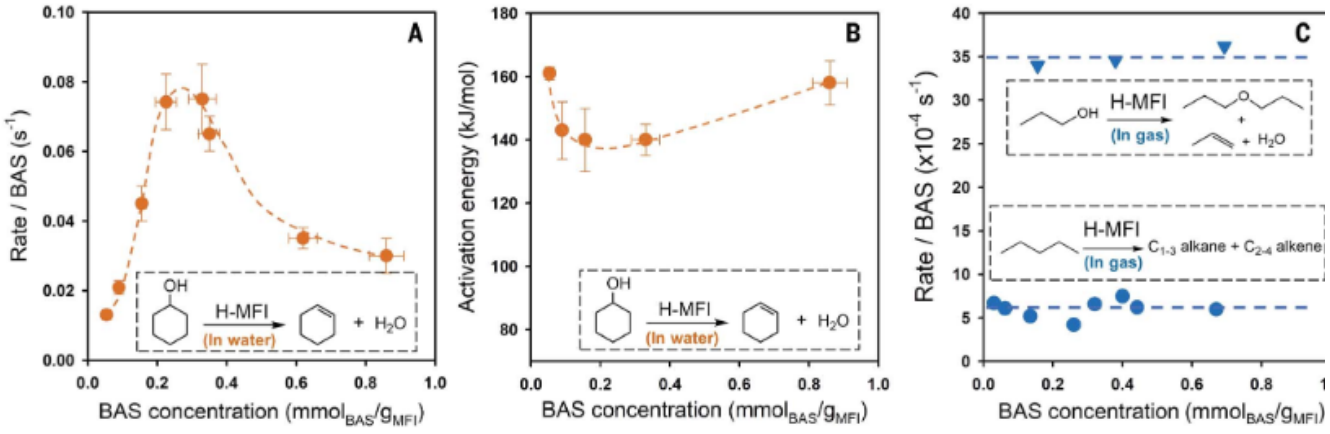
Abstract：Tailoring the molecular environment around catalytically active sites allows for the enhancement of catalytic reactivity through a hitherto unexplored pathway. In zeolites, the presence of water creates an ionic environment via the formation of hydrated hydronium ions and the negatively charged framework aluminum tetrahedra. The high density of cation-anion pairs determined by the aluminum concentration of a zeolite induces a high local ionic strength that increases the excess chemical potential of sorbed and uncharged organic reactants. Charged transition states (carbocations for example) are stabilized, which reduces the energy barrier and leads to higher reaction rates. Using the intramolecular dehydration of cyclohexanol on H-MFI zeolites in water, we quantitatively show an enhancement of the reaction rate by the presence of high ionic strength as well as show potential limitations of this strategy.

摘要翻译：通过调整催化活性位点周围的分子环境，可以通过迄今尚未探索的途径增强催化反应性。在沸石中，水的存在通过形成水合氢离子和带负电荷的框架铝四面体创造了一个离子环境。

由沸石的铝浓度决定的高的阳离子-阴离子对的密度导致了高的局部离子强度，增加了吸附和不带电的有机反应物的过量化学势。带电的过渡态（例如碳正离子）是稳定的，这降低了能量位垒，导致更高的反应速率。

利用环己醇在水中 H-MFI 上的分子内脱水，我们定量地证明了高离子强度的存在提高了反应速率，以及这种策略的潜在局限性。

文中插图：



[2]Control of polarization in bulk ferroelectrics by mechanical dislocation imprint

机械位错压印控制体铁电体的极化

出版信息：Science, 28 MAY 2021, VOL 372, ISSUE 6545

作者：Marion Höfling, Xiandong Zhou, Lukas M. Riemer, Enrico Bruder, et al.

第一作者单位：Department of Materials and Earth Sciences, Technical University of Darmstadt, 64287 Darmstadt, Germany.

全文链接：https://science.sciencemag.org/content/372/6545/961

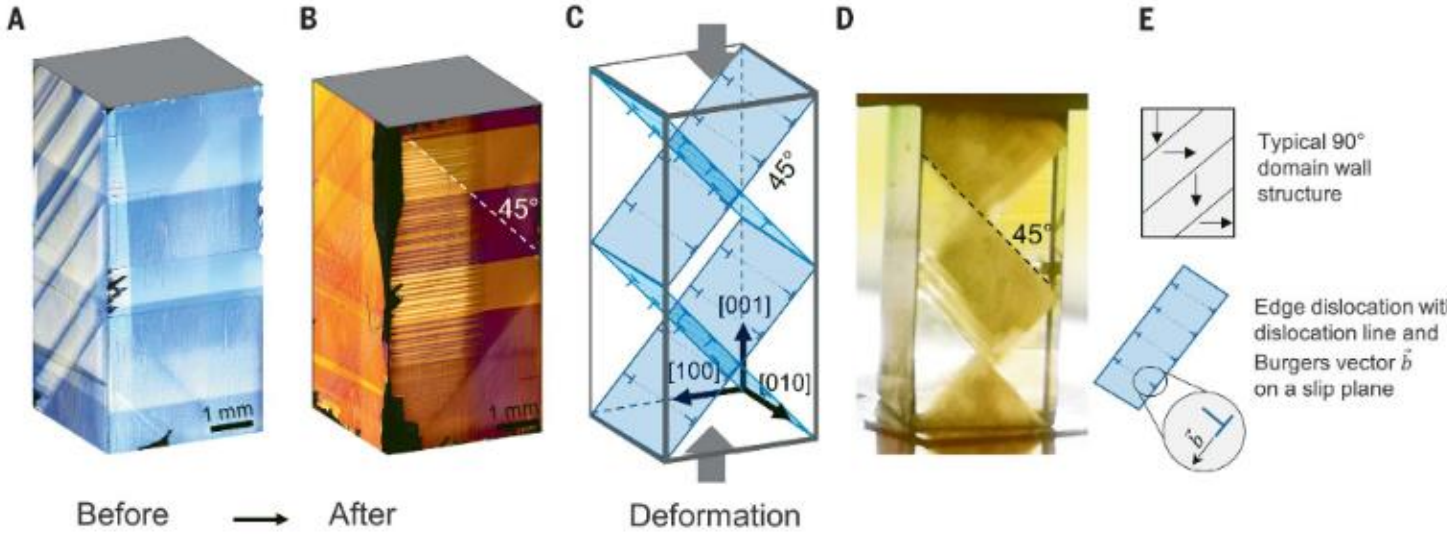
Abstract：Defects are essential to engineering the properties of functional materials ranging from semiconductors and superconductors to ferroics. Whereas point defects have been widely exploited, dislocations are commonly viewed as problematic for functional materials and not as a microstructural tool. We developed a method for mechanically imprinting dislocation networks that favorably skew the domain structure in bulk ferroelectrics and thereby tame the large switching polarization and make it available for functional harvesting. The resulting microstructure yields a strong mechanical restoring force to revert electric field–induced domain wall displacement on the macroscopic level and high pinning force on the local level. This induces a giant increase of the dielectric and electromechanical response at intermediate electric fields in barium titanate [electric field–dependent permittivity (ε_{33}) ≈ 5800 and large-signal piezoelectric coefficient (d_{33}^*) ≈ 1890 picometers/volt]. Dislocation-based anisotropy delivers a different suite of tools with which to tailor functional materials.

摘要翻译：缺陷对于功能材料（从半导体、超导体到铁质）的性能工程是至关重要的。虽然点缺陷已经被广泛地利用，但位错通常被认为是功能材料的问题，而不是作为一种微观结构工具。

我们开发了一种机械印迹位错网络的方法，该方法有利于倾斜块铁电体中的畴结构，从而驯服大的开关极化，使其可用于功能捕获。由此产生的微观结构在宏观上产生强大的机械恢复力来逆转电场引起的畴壁位移，在局部上产生高的钉扎力。

这导致钛酸钡在中间电场下的介电和机电响应显著提高[电场相关介电常数(ε_{33})≈5800，大信号压电系数(d_{33}^*)≈1890 皮米/伏]。基于位错的各向异性提供了一套不同的方法，用于定制功能材料。

文中插图：



[3]The chain of chirality transfer in tellurium nanocrystals

碲纳米晶体的手性转移链

出版信息：Science 09 Apr 2021:Vol. 372, Issue 6538, pp. 187-190

作者：Assaf Ben-Moshe, Alessandra da Silva, Alexander Müller, Anas Abu-Odeh, Patrick Harrison, Jacob Waelder

第一作者单位：Materials Sciences Division, Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA.

全文链接：https://science.sciencemag.org/content/372/6543/729

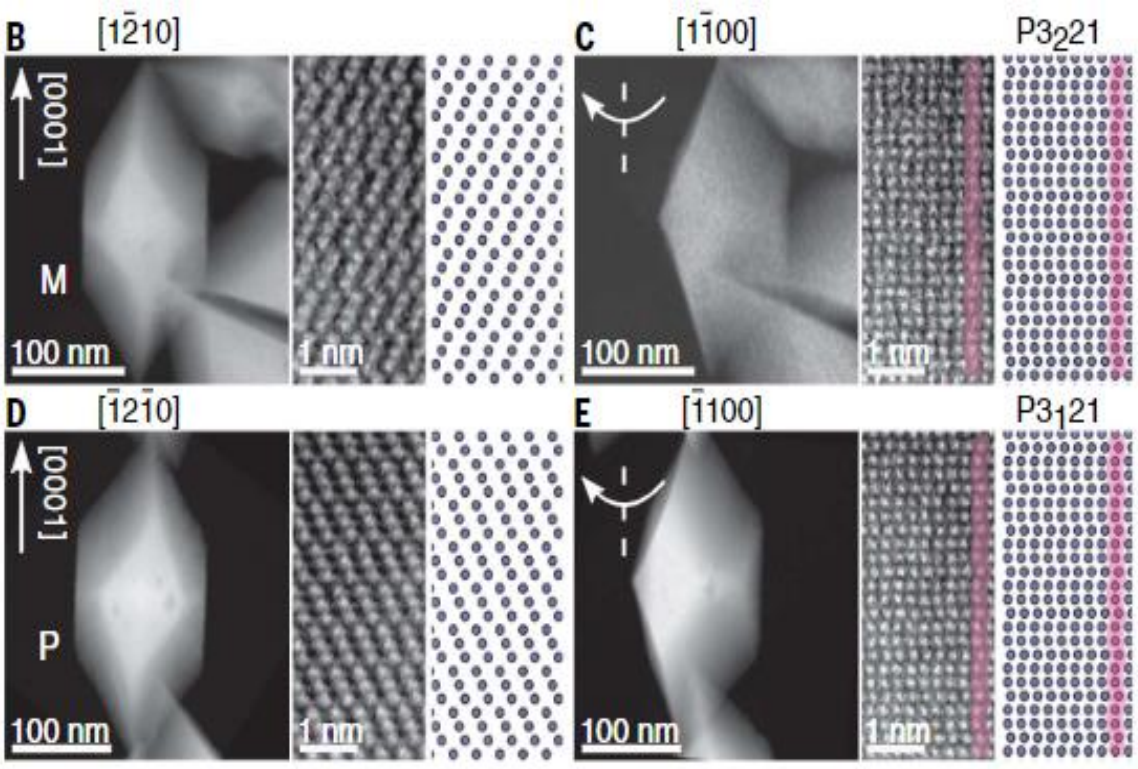
Abstract：Despite persistent and extensive observations of crystals with chiral shapes, the mechanisms underlying their formation are not well understood. Although past studies suggest that chiral shapes can form because of crystallization in the presence of chiral additives, or because of an intrinsic tendency that stems from the crystal structure, there are many cases in which these explanations are not suitable or have not been tested. Here, an investigation of model tellurium nanocrystals provides insights into the chain of chirality transfer between crystal structure and shape. We show that this transfer is mediated by screw dislocations, and shape chirality is not an outcome of the chiral crystal structure or ligands.

摘要翻译：虽然人们对具有手性形状的晶体进行了持续和广泛的观察，但其形成机制仍有待明确。

尽管过去的研究表明，手性形状的形成可能是由于存在手性添加剂的结晶，或由于晶体结构的内在趋势，但在许多情况下，这些解释并不适用或尚未得到验证。

碲纳米晶体模型的研究提供了对晶体结构和形状之间的手性转移链的观点。研究组发现这种转移是由螺位错介导的，形状手性并非手性晶体结构或配体的结果。

文中插图：



[4]Electric field control of superconductivity at the LaAlO3/KTaO3(111)interface

电场控制 LaAlO3/KTaO3(111)界面超导

出版信息: Science, 14 MAY 2021, VOL 372, ISSUE 6543

作者： Zheng Chen, Yuan Liu, Hui Zhang, Zhongran Liu, He Tian, Yanqiu Sun, et al.

第一作者单位： Interdisciplinary Center for Quantum Information, State Key Laboratory of Modern Optical Instrumentation, and Zhejiang Province Key Laboratory of Quantum Technology and Device, Department of Physics, Zhejiang University, Hangzhou 310027, China.

国内相关报道： http://physics.zju.edu.cn/2021/0517/c39070a2375221/page.htm

全文链接： https://science.sciencemag.org/content/372/6543/721

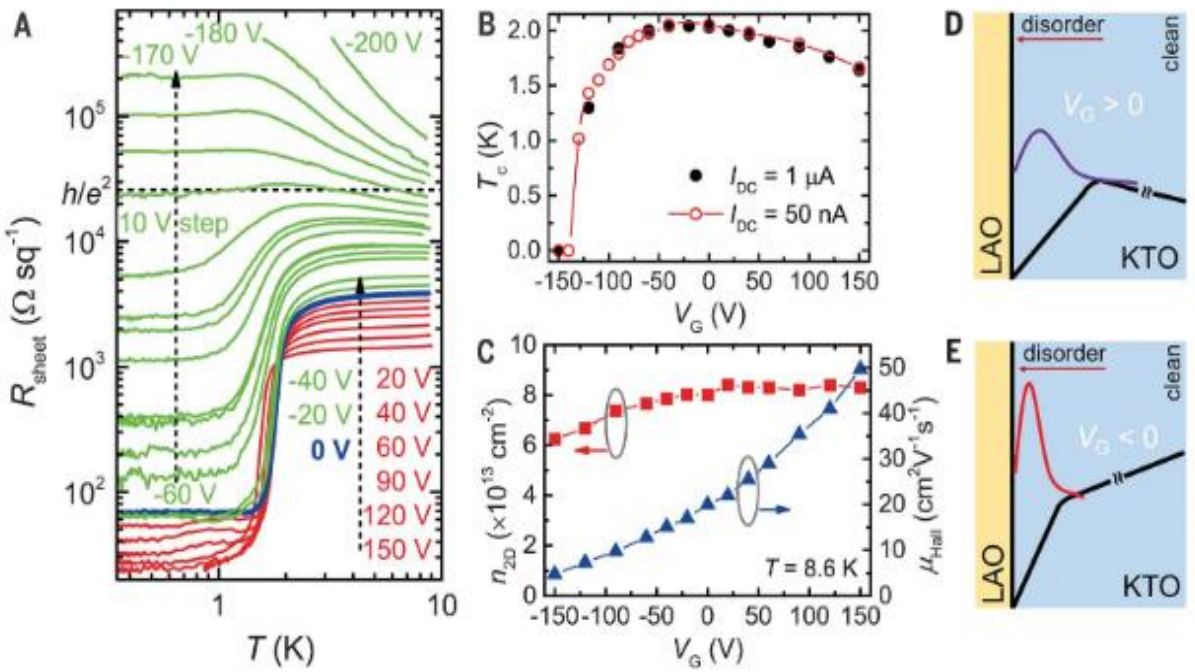
Abstract： The oxide interface between LaAlO3 and KTaO3（111） can harbor a superconducting state. We report that by applying a gate voltage (VG) acrossKTaO3, the interface can be continuously tuned from superconducting into insulating states, yielding a dome-shaped Tc-VG dependence, where Tc is the transition temperature. The electric gating has only a minor effect on carrier density but a strong one on mobility. We interpret the tuning of mobility in terms of change in the spatial profile of the carriers in the interface and hence, effective disorder. As the temperature is decreased, the resistance saturates at the lowest temperature on both superconducting and insulating sides, suggesting the emergence of a quantum metallic state associated with a failed superconductor and/or fragile insulator.

摘要翻译： LaAlO3 与 KTaO3（111）之间的氧化物界面具有超导态。

研究组报道，通过在 KTaO3 上施加栅极电压（VG），可将界面从超导态持续调谐至绝缘态，从而产生圆顶状 Tc-VG 依赖性，其中 Tc 是转变温度。电门控对载流子密度的影响很小，但对迁移率的影响很大。

研究组根据界面中载流子空间分布的变化来解释迁移率的调谐，即有效无序。当温度降低时，超导侧和绝缘侧的电阻在最低温度下饱和，这表明出现了失效的超导体和/或脆弱的绝缘体相关的量子金属态。

文中插图：



[5]Long-range nontopological edge currents in charge-neutral graphene

电荷中性石墨烯中的长程非拓扑边缘电流

出版信息：Nature, 27 May 2021, VOL 593, ISSUE 7860

作者：A. Aharon-Steinberg, A. Marguerite, D. J. Perello, K. Bagani, T. Holder, Y.

第一作者单位：Laboratory of Thin Films and Photovoltaics, Empa – Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland

全文链接：https://www.nature.com/articles/s41586-021-03501-7

Abstract：Van der Waals heterostructures display numerous unique electronic properties. Monolayer, bilayer and few-layer graphene, transition-metal dichalcogenides and moiré superlattices have been found to display pronounced nonlocal effects. However, the origin of these effects is hotly debated. Graphene, in particular, exhibits giant nonlocality at charge neutrality, a striking behaviour that has attracted competing explanations. Using a superconducting quantum interference device on a tip (SQUID-on-tip) for nanoscale thermal and scanning gate imaging, here we demonstrate that the commonly occurring charge accumulation at graphene edges leads to giant nonlocality, producing narrow conductive channels that support long-range currents. Unexpectedly, although the edge conductance has little effect on the current flow in zero magnetic field, it leads to field-induced decoupling between edge and bulk transport at moderate fields. The resulting giant nonlocality at charge neutrality and away from it produces exotic flow patterns that are sensitive to edge disorder, in which charges can flow against the global electric field. The observed one-dimensional edge transport is generic and nontopological and is expected to support nonlocal transport in many electronic systems, offering insight into the numerous controversies and linking them to long-range guided electronic states at system edges.

摘要翻译：范德华异质结构显示出许多独特的电子性质。单层、双层和薄层石墨烯、过渡金属二卤化物和莫尔超晶格已被发现显示出明显的非局域效应。

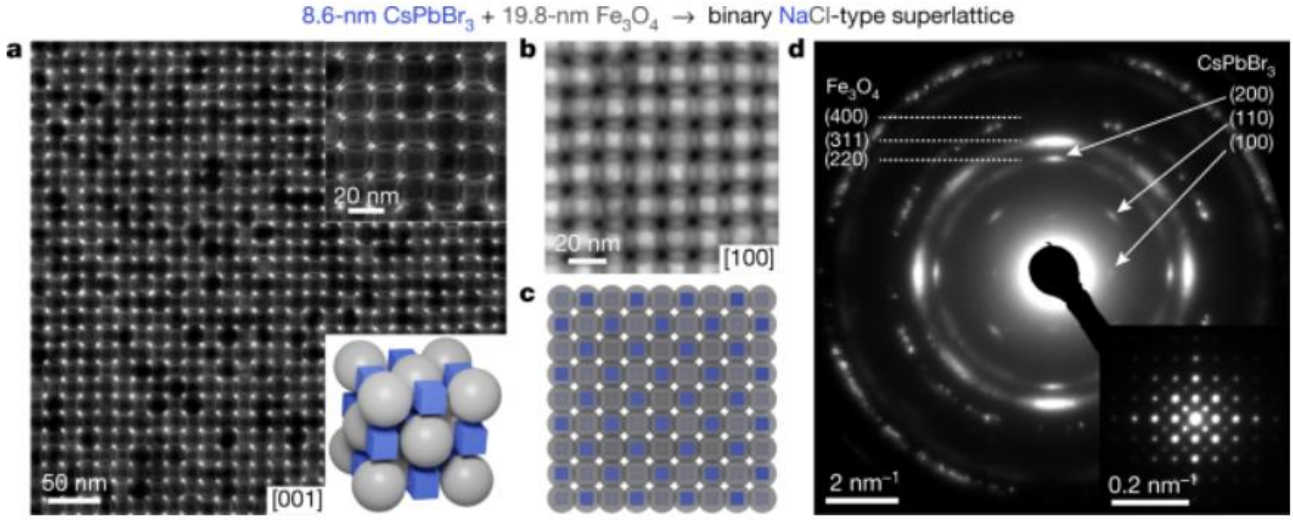
然而，这些效应的起源却引起了激烈的争论。尤其是石墨烯，在电荷中性时表现出巨大的非局域性，这一惊人行为吸引了各种不同的解释。

利用尖端超导量子干涉装置（SQUID-on-tip）进行纳米尺度的热成像和扫描门成像，研究组证明了石墨烯边缘常见的电荷积累会导致巨大的非局域性，产生了支持长程电流的狭窄导电通道。

出乎意料的是，虽然边缘电导对零磁场中的电流流动影响不大，但在中等磁场下，它会导致边缘和体输运之间的场诱导解耦。由此产生的巨大非局域性在电荷中性和远离电荷时产生了对边缘无序敏感的奇异流型，在这种流型中电荷可以对抗全局电场流动。

所观察到的一维边缘输运是通用和非拓扑的，有望支持许多电子系统中的非局域输运，为深入研究众多争论提供了线索，并将它们与系统边缘的远程引导电子态联系起来。

文中插图：



[1]Perovskite-type superlattices from lead halide perovskite nanocubes

卤化铅钙钛矿纳米立方体的钙钛矿型超晶格

出版信息：Nature, 27 May 2021, VOL 593, ISSUE 7860

作者：Ihor Cherniukh, Gabriele Rainò, Thilo Stöferle, Max Burian, Alex Travesset, Denys Naumenko, et al.

第一作者单位：Laboratory of Thin Films and Photovoltaics, Empa – Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland

全文链接：https://www.nature.com/articles/s41586-021-03492-5

Abstract：Caesium lead halide perovskite nanocrystals are promising building blocks for long-range-ordered superlattices, owing to the high oscillator strength of bright triplet excitons, slow dephasing (coherence times of up to 80 picoseconds) and minimal inhomogeneous broadening of emission lines. So far, only single-component superlattices with simple cubic packing have been devised from these nanocrystals. Here we present perovskite-type (ABO3) binary and ternary nanocrystal superlattices, created via the shape-directed co-assembly of steric-stabilized, highly luminescent cubic CsPbBr3 nanocrystals (which occupy the B and/or O lattice sites), spherical Fe3O4 or NaGdF4nanocrystals (A sites) and truncated-cuboid PbS nanocrystals (B sites). TheseABO3 superlattices, as well as the binary NaCl and AlB2 superlattice structures that we demonstrate, exhibit a high degree of orientational ordering of theCsPbBr3 nanocubes. They also exhibit superfluorescence—a collective emission that results in a burst of photons with ultrafast radiative decay (22 picoseconds) that could be tailored for use in ultrabright (quantum) light sources. Our work paves the way for further exploration of complex, ordered and functionally useful perovskite mesostructures.

摘要翻译：铯-铅卤化物钙钛矿型纳米晶体是长程有序超晶格很有前途的构建基块，因其明亮三重态激子的高振荡强度、缓慢失相（高达 80 皮秒的相干时间）和最小发射线不均匀展宽。到目前为止，人们从这些纳米晶体中仅设计出来单组分超晶格与简单立方堆积。

研究组提出了钙钛矿型（ABO3）二元和三元纳米晶超晶格，通过立体稳定、高发光的立方 CsPbBr3 纳米晶（占据 B 和/或 O 晶格位）、球形 Fe3O4 或 NaGdF4 纳米晶（A 位）和截角立方 PbS 纳米晶（B 位）的形状定向共组装而成。

这些 ABO3 超晶格，以及研究组展示的二元 NaCl 和 AlB2 超晶格结构，均表明了 CsPbBr3 纳米立方体的高度取向有序性。它们还表现出超荧光——一种集体发射，导致超快辐射衰减（22 皮秒）的光子爆发，可用于定制超亮（量子）光源。

研究组的工作为进一步探索复杂有序、功能有用的钙钛矿介观结构奠定了基础。

文中插图：