上海大学 SHANGHAI UNIVERSITY

SHUGLOBAL SHANGHAI UNIVERSITY 上海大学国际部

NEWSLETTER

2024 5 - 6

RESEARCH

Shanghai University (SHU) is one of the top 40 Chinese universities, top 100 Asian universities, the premier university of Shanghai, and a member of China Project 211 Universities. It is a comprehensive university offering 101 undergraduate programs, 180 graduate programs, and 95 doctoral programs in various disciplines including science, humanities & social sciences, engineering, economics & management, art, etc..

SHU was founded in 1922, and has been developed into a university with profound academic traditions and outstanding research facilities, embracing students from various countries with its global outlook. Just like the city of Shanghai, SHU has undergone dramatic changes in the past few decadesturning into a multicultural community with tremendous opportunities and resources.

SHU is inspired to build a highly effective platform for "Developing Talent", "Conducting Science & Technology Research", and "Serving Society". Faculty and students can grow together in a supportive and pleasant learning environment. Through the continuous improvement of the "All-round and whole-person" education model, SHU aims at providing society graduates cultivated with global vision, citizenship consciousness, humanity mindset, innovative spirit and practical ability to meet future challenges. Based on the contribution of our top-level faculty and diligent students, SHU has achieved collaboration with 255 universities in 55 nations and regions.

Shanghai University:https://en.shu.edu.cn/
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With a clear educational mission and objectives on talent cultivation, combined with global perspectives and creative awareness, Shanghai University(SHU) aims to become a key player in both the domestic and overseas education sectors.

Currently, Shanghai University is equipped with a National-Level University Science Park, a New and High-Tech Development Zone, and over 100 multi-disciplinary research institutes and research centers.

For the past five years, the amount of funding for SHU's scientific research has ranked around 25th among all the domestic universities and colleges; the total number of academic papers indexed by the three International Retrieval Systems (SCI, EI, and ISTP) has been rated approximately 30th, and the number of applied and authorized patents is about 20th.

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China Daily Published An Article By Cheng Danhong, Chairperson Of The Shanghai University Council, Entitled “Educational Openness Can Boost Innovation”.

《中国日报》刊发上海大学党委书记成旦红署名文章，推介“国际化的上海大学”

Educational openness can boost innovation

Cheng Danhong

Education, especially openness in education, plays a pivotal role in shaping the future of a nation. And given China’s rapidly evolving global engagement, the need for further openness in the education sector couldn’t be more urgent. As China navigates unprecedented shifts and chasms in the global landscape and embarks on the journey to achieve national rejuvenation, Chinese universities find themselves at the forefront of promoting China’s higher education sector globally.

At the heart of China’s strategy of educational openness lies the mission to promote innovation-driven high-quality development, characterized by robust global cooperation. Despite the significant progress made in this regard, there is still room for sharpening the competitive edge of China’s higher education sector. While the gross enrolment rate in higher education reached 60.2 percent in 2023, indicating China has reached the stage of massification of education, challenges remain in terms of original academic output, industrial application of the results of research in cutting-edge technologies and measures in attracting top global talents.


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Educational openness can boost innovation

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A living dilemma that faces elderly people

To address these challenges, Chinese universities, particularly those in Shanghai, should leverage their regional features and ensure their policies are in line with global trends. By integrating advanced resources from across the globe and continuously providing better, even world-class, education, these institutions can forge a pattern of open cooperation and development. Of course, that would entail proactive engagement with global partners, alignment with projects like the Belt and Road Initiative, and the promotion of collaborative networks to boost knowledge exchange.

Deepening global cooperation is key to promoting innovation and facilitating the high-quality development of different disciplines. So Chinese universities must develop a global perspective in their pursuit of scientific and technological advancement, and collaborate with top-tier institutions globally to establish academic communities at the forefront of knowledge production.

Shanghai University has made serious efforts to integrate into the global innovation network, thereby boosting its research capability by developing advanced technology and interdisciplinary studies, building and consolidating global research platforms to promote innovation, and creating innovative models for collaboration between domestic and foreign educational institutions.

Simultaneously, the cultivation of global talents has become a priority for China in its efforts to take forward its agenda of educational openness. As China competes on the global stage, talents become the ultimate determinant of success. So universities need to instill a sense of patriotism among students, help them learn the ropes and develop a global perspective needed to gain competency in cross-cultural affairs and acquire global leadership. Institutions should also help expand students’ horizons, facilitate knowledge exchange with overseas partners and foster a culture of global citizenship.

In practical terms, this would require the establishment of a global talent cultivation system, comprising elements of training, learning and practical experience. Chinese universities, particularly those in Shanghai, have made significant strides in this regard, forging partnerships with leading global institutions and facilitating student exchange programs and internships on a global scale. Such initiatives not only enhance students’ academic and professional development but also cultivate a competent workforce capable of driving China’s future growth.

Adhering to the “going out” policy and adopting a comprehensive approach to “training, learning, internship, and practical experience”, universities have established distinctive global

education programs, which should help expand students' vision, make them more competent and competitive, enhance their overall quality and raise their innovation capacity.

Shanghai University has collaborated with 58 of the world's top 200 universities for mutual credit recognition, facilitating overseas student exchange programs. In fact, for the past two years, Shanghai University students have been selected for internship at different United Nations organizations, which will cultivate globally competitive young talents.

Also, universities should develop localized international education models, by "bringing in" expertise, putting education resources in the local context across three fields — specialized courses, international faculty and campus culture — expeditiously building a global curriculum system, aligning course content with global standards, and working out a seamless global education model from the bachelor's to the doctoral degree.

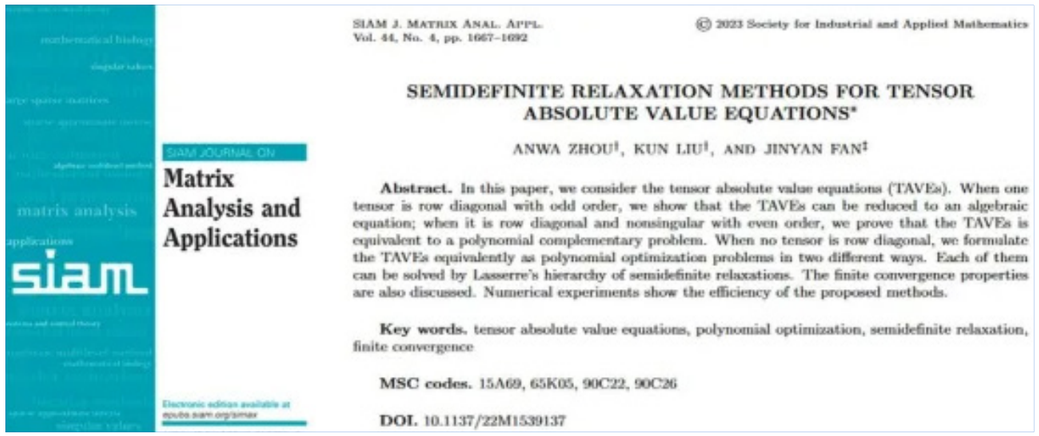
They should also recruit highly qualified faculty members from abroad, help them conduct high-level research in collaboration with leading universities worldwide to boost the innovation capacity of Chinese universities, and organize global cultural and academic events to foster an internationalized atmosphere on the campus.

There is also a need to cultivate talents from among international students studying in China, so they can serve as China's "ambassadors" and narrate China's stories globally. In this regard, Shanghai University, by offering high-quality specialized courses for foreign students, aims to nurture international students who understand and love China, so they can present a credible and adorable image of China to the world. As a matter of fact, an animated cartoon, titled The Song of New China, created by a Turkmenistan student at Shanghai University, went viral online, garnering 164 million views, including a large percentage from abroad.

Openness is the anchor of Chinese education's global engagement strategy, offering a path to enhanced competitiveness, innovations and collaborations on the world stage. As Chinese universities embark on the journey of internationalization, they must seize the opportunities presented by globalization and overcome the challenges inherent in cross-cultural exchanges and cooperation. By nurturing global talents, promoting interdisciplinary collaboration, and embracing digital innovation, Chinese universities can position themselves as leading global institutions, driving forward China's vision for educational excellence and global leadership.

Prof. Zhou Anwa's Team Publishes Latest Research In The "Siam Journal On Matrix Analysis And Applications"

理學院周安娃副教授團隊在《SIAM Journal on Matrix Analysis and Applications》期刊發表最新研究成果



This article discusses a semidefinite relaxation algorithm for solving tensor absolute value equations. It begins with tensor absolute value equations that have row-diagonal tensors. If the tensor has an odd order, the tensor absolute value equation becomes an algebraic equation. If the tensor has an even order and is non-singular, it's shown that the tensor absolute value equation is equivalent to a polynomial complementarity problem. The paper also explores general tensor absolute value equations, demonstrating two distinct ways to convert them into polynomial optimization problems. Finally, the study proposes semidefinite relaxation algorithms to solve these transformed polynomial optimization problems and discusses the algorithm's finite convergence. Numerical experiments confirm the algorithm's effectiveness.

本文研究了求解張量絕對值方程的半定鬆弛演算法。首先，對於帶有行對角張量的張量絕對值方程：若該張量是奇數階，則張量絕對值方程即退化為代數方程；若該張量為偶數階且非奇異，證明了張量絕對值方程等價於一個多項式互補問題。其次，對於一般的張量絕對值方程問題，分別以兩種不同的方式將其等價轉化為多項式優化問題。最後，對於上述等價轉化後的多項式優化問題，分別提出半定鬆弛演算法對其求解，並討論了演算法的有限收斂性。數值實驗表明所提演算法的有效性。

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https://doi.org/10.1137/22M1539137

Prof. Kang Liying’s Team Publishes Latest Research In The “Journal Of Combinatorial Theory, Series B”

理學院康麗英教授團隊在《Journal of Combinatorial Theory, Series B》期刊發表最新研究成果

Spectral extremal problems are a major and active area of research in combinatorics and graph theory, focusing on the extremal values of some spectral parameters within a given class of graphs. Spectral Turán-type extremal problem is a classic problem of these issues, extending Turán-type extremal problems to spectral graph theory. In recent years, this area has attracted the interest of numerous renowned scholars, leading to significant breakthroughs.

In their paper “The spectral radius of graphs with no odd wheels” (European J. Combin., 99: 103420, 2022), Cioabă, Desai, and Tait proposed that given a graph F, if its extremal graph can be obtained by adding a constant number of edges to a Turán graph, then when n is sufficiently large, the graphs with the largest adjacency spectral radius over all n-vertex F-free graphs must also have the maximum number of edges among these graphs.

Using the spectral stability theorem and the method of structural analysis, this paper solves the conjecture completely, presenting a stronger result than the conjecture. It proves that if the extremal number of a given graph F is the number of edges of Turán graph plus a constant, then when n is large enough, the graph with the largest adjacency spectral radius over all n-vertex F-free graphs must also have the maximum number of edges among these graphs. This research makes a significant advance in the study of spectral extremal problems.

譜極值問題是組合圖論領域中一個重要和活躍的研究方向，該問題研究給定圖類中某些譜參量的極值。圖的譜 Turán 型極值問題是一類經典的譜極值問題，也是圖的 Turán 型極值問題在圖譜理論中的延伸。近年來，此類問題受到全球眾多知名學者的關注並取得了一系列重要突破。Cioabă, Desai 和 Tait [The spectral radius of graphs with no odd wheels. European J. Combin., 99: 103420, 2022] 提出了如下猜想：給定圖 F, 如果 F 的極值圖可以通過 Turán 圖加上常數條邊得到，則當 n 足夠大時，不包含 F 作為子圖的 n 階圖中鄰接譜半徑達到最大的圖一定也是禁用 F 的圖中邊數達到最大的圖。本文利用譜穩定性定理和結構分析的方法，徹底解決了上述猜想，並給出了一個比 Cioabă, Desai 和 Tait 的猜想更強的結果。該文證明了：給定圖 F, 如果 F 的極值數為 Turán 圖的邊數加上一個常數時，則當 n 足夠大時，不包含 F 作為子圖的 n 階圖中鄰接譜半徑達到最大的圖一定也是禁用 F 的圖中邊數達到最大的圖。這項研究工作極大地推動了譜極值問題的研究。


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On a conjecture of spectral extremal problems ☆

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ABSTRACT

For a simple graph F, let $\mathrm{Ex}(n, F)$ and $\mathrm{Ex}_{sp}(n, F)$ denote the set of graphs with the maximum number of edges and the set of graphs with the maximum spectral radius in an n-

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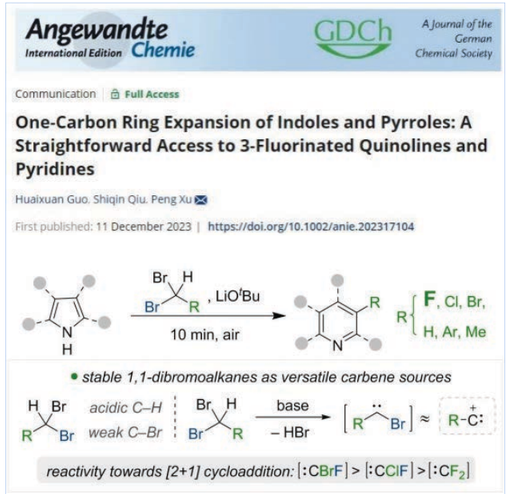
Prof. Xu Peng’s Team Publishes Latest Research In “Angewandte Chemie International Edition”

理學院徐鵬教授課題組在《Angewandte Chemie International Edition》期刊發表最新研究成果


Angewandte International Edition Chemie

GDCh A Journal of the German Chemical Society

Communication | Full Access

One-Carbon Ring Expansion of Indoles and Pyrroles: A Straightforward Access to 3-Fluorinated Quinolines and Pyridines

Huaixuan Guo, Shiqin Qiu, Peng Xu

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Indoles and pyrroles, known for their diverse structures, are common in natural products and pharmaceuticals, making them important building blocks in synthetic chemistry. While past studies have mainly focused on peripheral editing of these molecules, such as C–H bond functionalization, skeletal modifications are less common but offer considerable synthetic value.

Professor Xu Peng’s team has developed a novel method for one-carbon ring expansion of indoles and pyrroles. Using readily available indoles and pyrroles as starting materials and dibromofluoromethane as a bromofluoro carbene precursor, the process involves a [2+1] cycloaddition, fragmentation, and aromatization sequence to construct 3-fluoroquinolines and pyridines efficiently. This straightforward protocol requires only a short reaction time of ten minutes and can be performed under air atmosphere.

The study revealed that other dibromoalkanes could also work for the one-carbon ring expansion of indoles and pyrroles, forming structurally diverse quinolines and pyridines. This indicates that the reaction strategy has good versatility, paving the way for broader applications in synthetic chemistry.

結構類型豐富的吲哚和吡咯化合物在天然產物和藥物分子中普遍存在，是合成化學中重要的合成子。以前的研究主要集中在吲哚和吡咯分子的外圍編輯，如 C–H 鍵的功能化。相比之下，對吲哚和吡咯的分子骨架進行編輯則相對罕見，但是卻具有重要的合成價值。在本研究中，徐鵬課題組以二溴氟甲烷作為溴氟卡賓前體，選擇易於獲得的吲哚和吡咯為起始原料，通過 [2+1] 環加成 – 碎片化 – 芳構化串聯過程來實現吲哚和吡咯的單碳環擴張，實現了結構多樣的 3-氟代喹啉和吡啶類化合物的高效構建。該方法具有良好的實用性，無需惰性氣體保護，在空氣氛圍中即可進行，且反應只需要 10 分鐘。此外，研究還發現其他結構類型的 1,1- 二溴代烷烴化合物也能夠與吲哚和吡咯化合物進行單碳環擴張生成喹啉和吡啶類化合物，表明該反應策略具有良好的普適性。

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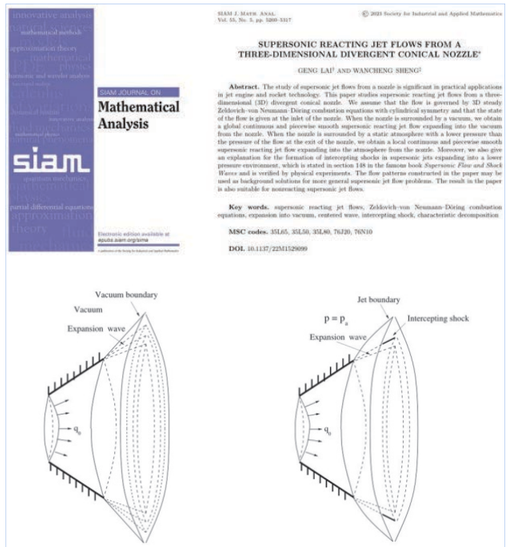
https://onlinelibrary.wiley.com/doi/10.1002/anie.202317104

Prof. Sheng Wancheng’s Team Publishes Latest Research In The “Siam Journal On Mathematical Analysis”

理學院盛萬成教授“黎曼雙曲”團隊在《SIAM Journal on Mathematical Analysis》期刊發表最新研究成果



As the continuous progress of science and technology, the demand for ramjet engines in aerospace and defense grows. These engines typically consist of a diffuser, combustion chamber, and nozzle, each presenting complex challenges. Divergent conical nozzles, often used in ramjet engines, produce jets that can reach supersonic or even hypersonic speeds, widely applied in modern aircraft, missiles, and rockets.

Professor Sheng Wancheng’s “Riemann Hyperbolic” team investigated supersonic gas jets through a three-dimensional divergent conical nozzle by solving the free boundary problem of the three-dimensional axisymmetric Zeldovich-von Neumann-Döring (ZND) combustion equations. The study yielded two significant results. First, when the nozzle’s external environment is a vacuum, they derived a global classical solution for the jet from the nozzle to the vacuum (as shown in the left figure). Second, when the external environment isn’t a vacuum and has lower pressure than the nozzle, they obtained a local classical solution for the jet and clarified the mechanism of shock interception in the jet (as shown in the right figure).

Using characteristic decomposition, the team estimated the C^1 solution for the free boundary problem, providing evidence of a global classical solution’s existence and cases where this solution might break down.

隨著科学技術的不斷進步，衝壓式噴氣發動機在航空航天和國防領域的需求在持續增長。衝壓式噴氣發動機主要由擴壓器，燃燒室和噴管三部件組成。每個部件中都有廣泛的複雜的問題需要解決。衝壓式噴氣發動機採用的噴管通常是拉瓦爾噴管，其射流噴出的速度達到超音速甚至高超音速，被廣泛應用于現代飛行器，導彈和火箭等領域。盛萬成教授“黎曼雙曲”團隊通過求解三維柱對稱 Zeldovich-von Neumann-Döring (ZND) 燃燒方程的自由邊界問題，對經過三維錐形噴管的燃氣超聲速射流進行了分析，得到了兩個重要結果。當噴管外界為真空時，該論文構造了從噴管到真空的射流問題的全域經典解（下圖（左））；當噴管外界不為真空，且外界氣壓小於管口氣壓時，得到了射流問題的局部經典解以及射流中攔截激波的形成機制（下圖（右））。該論文主要採用特徵分解的方法對上述自由邊界問題的解做 C1 估計，進而得到全域經典解的存在性和經典解的破裂的結果。

Article Link:
https://doi.org/10.1137/22M1529099

Prof. Cao Shixun’s Team From College Of Sciences Publishes Latest Cooperation Research In “Nature Physics” On Nonlinear Light-Matter Coupling

理學院曹世勳教授團隊在《Nature Physics》期刊發表光與物質非線性耦合領域最新合作研究成果

An international research team, including physicists and chemists from Shanghai University and collaborators from MIT, the University of Texas at Austin, and UCLA, recently achieved a breakthrough in rare-earth orthoferrite ErFeO3 single crystals. They found that a strong terahertz field in these single crystals can drive a magnon upconversion process mediated by magnetic resonance. Using two-dimensional terahertz polarization methods, the team revealed the unidirectional coupling between different magnon modes in canted antiferromagnets. Further computational studies on spin dynamics suggest that this coupling is universal for antiferromagnets with canted magnetic moments (RFeO3), providing a solid theoretical foundation for future research in the field. The study, titled “Terahertz field-driven magnon upconversion in an antiferromagnet,” was published in “Nature Physics.”

上海大學理學院曹世勳教授團隊聯合美國麻省理工學院、德克薩斯大學奧斯丁分校、加州大學洛杉磯分校等物理學家和化學家組成的國際研究團隊，在稀土正鐵氧體 ErFeO3 單晶中取得了最新的研究突破。研究人員發現，在 ErFeO3 單晶中強太赫茲場可以驅動由磁共振介導的磁振子上轉換過程。利用二維太赫茲偏振法，研究人員揭示了傾角反鐵磁體不同磁振子模之間耦合的單向性質。自旋動力學的計算進一步表明這種耦合對於傾斜磁矩的反鐵磁體（RFeO3）具有普遍性，為相關領域的未來研究提供了堅實的理論基礎。該研究成果“Terahertz field-driven magnon upconversion in an antiferromagnet”發表在《Nature Physics》期刊上。

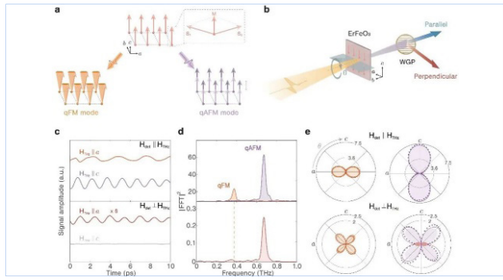


Figure 1: Terahertz field-driven magnon response of ErFeO3 and terahertz polarization measurements at room temperature.
圖 1：室溫下太赫茲場驅動 ErFeO3 的磁振子回應和太赫茲偏振測量

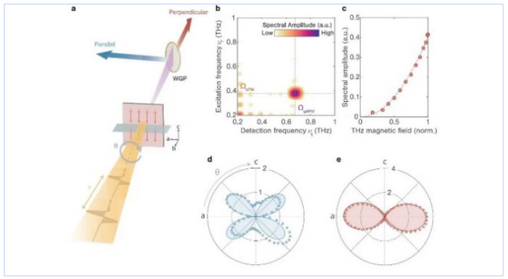


Figure 2: Two-dimensional terahertz spectra of magnon upconversion signals at room temperature.
圖 2：室溫下磁振子上轉換信號的二維太赫茲光譜圖

Related Article Links:
Jan. 2024, Nature Physics, https://rdcu.be/dwlcZ, OR https://doi.org/10.1038/s41567-023-02350-7
Oct. 2022, Nature Communications, 13, 6140 (2022) https://doi.org/10.1038/s41467-022-33520-5
Jan. 2022, Nature Communications, 13, 443 (2022) https://doi.org/10.1038/s41467-021-27267-8
May, 2021, Nature Communications, 12, 3115 (2021) https://doi.org/10.1038/s41467-021-23159-z
Aug. 2018, Science, 361 (6404), 794-797 http://science.sciencemag.org/content/361/6404/794

Prof. Yang Xihua’s Team Publishes Latest Research In “Physical Review Letters”

理學院楊希華教授在《Physical Review Letters》期刊發表最新研究成果

Quantum entanglement is a critical resource for quantum computation, communication, networking, and quantum information processing. How to conveniently and efficiently realize the generation and control of entangled bright light fields is the most fundamental and critical challenge in advancing quantum information for practical applications.

In contrast to the general thought that the collisions are intrinsically dephasing and harmful to quantum entanglement at room temperature or higher, this paper shows that in the conventional ladder-type electromagnetically induced transparency (EIT) configuration, when the probe field intensity is not very weak as compared to the pump field, the entanglement between the bright pump and probe fields can be remarkably enhanced with the increase of the collisional decay rates in a moderate range in an inhomogeneously-broadened atomic system. The strengthened entanglement results from the enhancement of constructive interference and suppression of destructive interference between one-photon and multi-photon transition pathways.

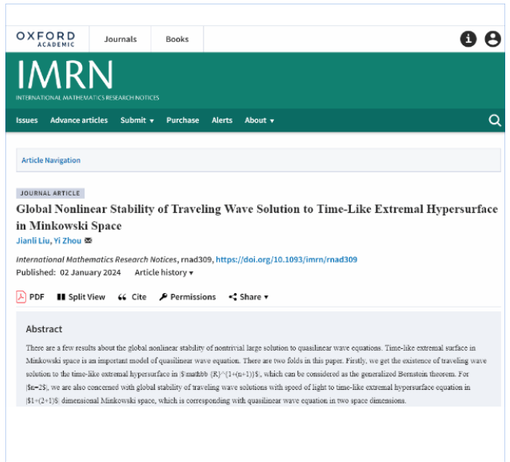
This method offers a simple and efficient way to generate and control quantum entanglement at room temperature or higher, providing promising applications in quantum computation and quantum information processing.

量子糾纏作為量子計算、量子通信與網路及量子信息處理的重要物理“資源”，如何簡便高效地實現亮光場間糾纏的製備及調控是量子信息推廣到實際應用進程中需要解決的最基本也是最關鍵問題。與通常人們所認為的碰撞本質上是消相干且在室溫或高溫下總是不利於量子糾纏的觀點不同，本論文論證了在傳統的非均勻加寬的原子梯型電磁感應透明（EIT）構型中，當探測場強度與泵浦場強度相比擬時，在適當的範圍內隨著碰撞弛豫速率的增加，泵浦場和探測場兩個亮光場間的量子糾纏可獲得顯著增強；泵浦場和探測場間糾纏的增強來源於單光子和多光子躍遷路徑間相長干涉的增強和相消干涉的抑制。該方案為室溫或高溫下實驗製備亮光場間量子糾纏提供了極大的便利，在實際的量子計算和量子信息處理中具有潛在的應用前景。

Article Link:
https://journals.aps.org/prl/accepted/db075YbbT771569885e39cf4f158fd54bf44e833f

Prof. Liu Jianli Publishes Latest Research In The “International Mathematics Research Notices”

理學院劉見禮教授在《International Mathematics Research Notices》期刊發表最新研究成果



His study addresses the global nonlinear stability of traveling wave solutions in Minkowski space, with a focus on time-like extremal hypersurfaces. These hypersurfaces are important in both string theory and particle physics, and they are critical subjects in differential geometry and partial differential equations.

Research on quasilinear wave equations typically examines small initial values that lead to global solutions or large solutions that tend to break down. Professor Liu Jianli, in collaboration with Professor Zhou Yi from Fudan University, expanded upon these topics by utilizing the equation’s inherent structure and applying weighted energy estimates. This approach allowed them to demonstrate the global nonlinear stability of traveling wave solutions, providing new insights and techniques for the study of quasilinear wave equations in Minkowski space and beyond.

本論文主要研究了 Minkowski 空間中的时向極值超曲面行波解的非線性穩定性。Minkowski 空間中的極值曲面為弦理論和粒子物理中的重要模型，同時也是微分幾何和偏微分方程中的重要研究对象。擬線性波動方程的整體經典解研究大多集中在小初值整體解或大解的破裂。劉見禮教授與合作者復旦大學周憶教授充分利用方程結構，引入加權能量估計，得到一類具有物理意義的“大”解的整體穩定性。其研究成果為研究一般擬線性波動方程的“大”解理論的研究提供方法和借鑒。

Article Link:
https://doi.org/10.1093/imrn/rnad309

Prof. Zhao Hongbin’s Team Publishes Latest Research In “Advanced Functional Materials”

理學院趙宏濱教授團隊在《Advanced Functional Materials》期刊發表最新研究成果

Professor Zhao Hongbin’s team made significant progress in the research of high-temperature electrolytes for lithium metal batteries. Their study, titled “Ether-Based Electrolyte for High-Temperature and High-Voltage Lithium Metal Batteries,” was published in “Advanced Functional Materials” (AFM), with Shanghai University as the lead corresponding institution.

The research introduces a high-temperature, high-voltage lithium metal electrolyte based on diethylene glycol dibutyl ether (DGDE). Raman spectroscopy and molecular dynamics simulations confirmed that 3-methoxypropionitrile (3-MPN) played a role in enhancing the coordination between anions and lithium, forming solvent complexes with aggregates (AGG) and contact ion pairs (CIP). Additionally, DGDE was effectively excluded from the solvation structure, which enhanced its oxidation resistance. This regulated solvation resulted in excellent battery performance, allowing it to be used in high-temperature and high-voltage lithium metal battery systems. The work offers valuable insights into developing electrolytes suitable for lithium metal batteries under a broad temperature range and high voltages, and it opens up new possibilities for the application of ether solvents.

理學院化學系趙宏濱教授團隊在鋰金屬電池高溫電解液研究領域取得重要的進展，相關成果發表在《Advanced Functional Materials》期刊，論文題目 為“Ether-Based Electrolyte for High-Temperature and High-Voltage Lithium Metal Batteries”，上海大學為第一通訊單位。

本研究介紹了一種基於二乙二醇二丁醚(DGDE) 的高溫高壓鋰金屬電解液。拉曼光譜和分子動力學模擬證實了 3- 甲氧基丙腈的參與增強了陰離子對鋰配位的參與，導致 AGG 和 CIP 的溶劑化配合物的形成。此外，DGDE 被有效地從溶劑化結構中排出，增強了其抗氧化性。這種調控的溶劑化結構導致優異的電池性能，使其應用在高溫高壓鋰金屬電池體系中。這項工作為開發適用鋰金屬電池在寬溫度和高電壓下工作的電解液提供了有價值的觀點，同時也為醚溶劑的新應用提供了新思路。

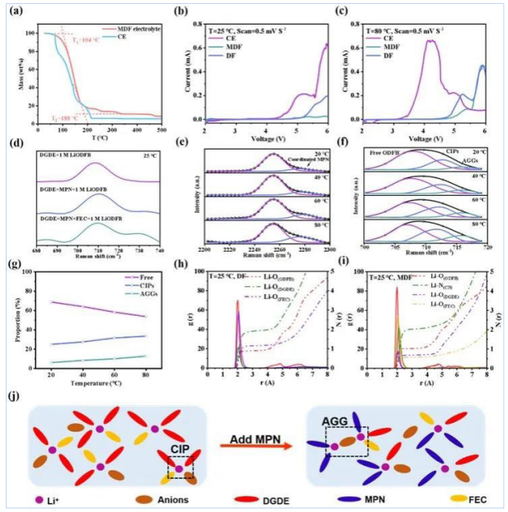


Figure 1: (a) Thermogravimetric Analysis (TGA) curves for different electrolytes. (b–c) Linear Sweep Voltammetry (LSV) at 25° C and 80° C for different electrolytes. (d–f) Raman spectra for various electrolytes; (g) Relative composition of OD–FB– in MDF electrolyte; (h–i) Radial distribution functions and coordination numbers for DF and MDF electrolyte; (j) Schematic representation of solvation structures for different electrolytes.

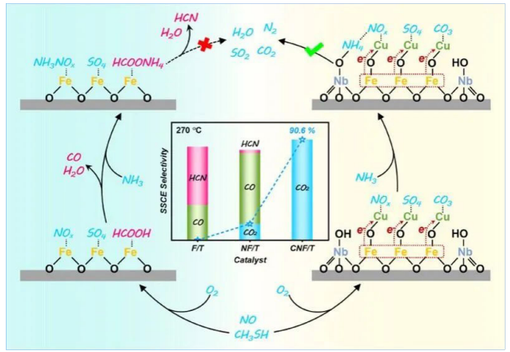
Article Link:
https://onlinelibrary.wiley.com/doi/full/10.1002/adfm.202313319

Prof. Zhang Dengsong’s Team From The College Of Sciences Publishes Latest Research In Es&T

理學院張登松教授團隊在 ES&T 發表最新研究成果

Professor Zhang Dengsong’s team from the Carbon Neutrality Innovation Research Center at Shanghai University has made significant progress in the study of synergistic catalytic purification of nitrogen oxides (NOx) and volatile organic compounds (VOCs). Their findings were published in “Environmental Science & Technology” (ES&T) with the paper titled “Selective Synergistic Catalytic Elimination of NOx and CH3SH via Engineering Deep Oxidation Sites against Toxic Byproducts Formation.” Shanghai University is the sole corresponding institution.

Professor Zhang Dengsong’s team engineered deep oxidation sites on a TiO2-supported Cu-modified Nb-Fe composite oxide catalyst to achieve selective synergistic catalytic elimination of NOx and CH3SH. This catalyst offers excellent catalytic removal performance for both NOx and CH3SH, with high selectivity for N2 and CO2. The authors used X-ray Photoelectron Spectroscopy (XPS), in-situ Raman spectroscopy, and in-situ diffuse reflectance infrared spectroscopy to reveal that continuous electron transfer from Nb-Fe composite oxide to Cu oxide led to the formation of deep oxidation sites on the catalyst’s surface. These sites deeply oxidize formic acid (HCOOH), a precursor of toxic byproduct carbon monoxide (CO), into carbon dioxide (CO2), thus preventing the formation of ammonium formate (HCOONH4) precursor of toxic hydrogen cyanide (HCN) when combined with ammonia (NH3). This research is significant for atmospheric pollution control by providing a selective approach to purifying multiple pollutants, such as NOx and VOCs, offering effective strategies and theoretical foundations for designing efficient catalysts to eliminate NOx and sulfur-containing volatile organic compounds (SVOCs).



理學院上海大學碳中和創新研究中心張登松教授團隊在氮氧化物與揮發性有機物協同催化淨化研究領域取得重要進展，相關成果以“Selective Synergistic Catalytic Elimination of NOx and CH3SH via Engineering Deep Oxidation Sites against Toxic Byproducts Formation” 為題發表在《Environmental Science & Technology》簡稱ES&T)期刊，上海大學為唯一通訊單位。

張登松教授團隊通過在 TiO2 負載的 Cu 改性 Nb-Fe 複合氧化物催化劑上構築的深度氧化位點實現了選擇性協同催化消除 NOx 和 CH3SH，該催化劑具有優秀的 NOx 和 CH3SH 催化去除性能，並擁有優異的 N2 和 CO2 選擇性。作者結合 XPS、原位拉曼光譜和原位漫反射紅外光譜表徵，闡明了從 Nb-Fe 複合氧化物到 Cu 氧化物的持續的電子轉移誘導生成了催化劑表面深度氧化位點。該位點可以將毒副產物 CO 的前驅體 HCOOH 深度氧化為 CO2，從而避免 HCOOH 進一步和 NH3 結合生成毒副產物 HCN 的前驅體 HCOONH4（圖 1）。本工作對大氣污染控制領域 NOx 與 VOCs 等多污染物的協同淨化具有重要意義，為未來設計高效選擇性協同催化去除 NOx 和 SVOCs 提供了有效的策略和理論依據。

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https://doi.org/10.1021/acs.est.3c06825

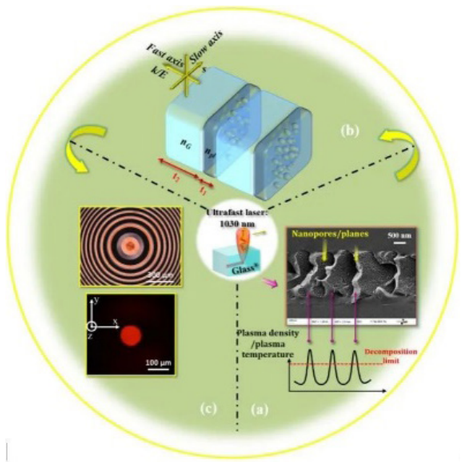
Prof. Dai Ye’s Team Publishes Review Paper In “Progress In Materials Science”

理學院戴曄教授團隊在《Progress in Materials Science》期刊發表綜述論文

Professor Dai Ye’s team from the Department of Physics at the College of Sciences, in collaboration with Professor Matthieu Lancry’s team from the ICMMO Laboratory at Paris-Saclay University, published a comprehensive review in the journal “Progress in Materials Science.” The review, titled “Materials Roadmap for Inscription of Nanogratings Inside Transparent Dielectrics Using Ultrafast Lasers,” consists of six chapters, 14 large images, and approximately 18,000 words.

The paper focuses on the “matter” aspect within “light-matter interactions,” discussing materials such as transparent dielectrics, semiconductors, and crystals. It examines the formation mechanisms of ultrafast laser-induced nanogratings over the past 20 years. The authors analyze the formation mechanism based on factors like periodicity, nanopore size, filling factors, and optical properties, such as the energy window for nanograting formation or destruction, maximum delay, and birefringence. Technical properties are also discussed, including energy consumption for inducing nanogratings, laser scanning speed, and thermal stability.

理學院物理系超快光子學實驗室戴曄教授團隊與巴黎薩克雷大學 ICMMO 實驗室 Matthieu Lancry 教授團隊合作發表了題為“Materials roadmap for inscription of nanogratings inside transparent dielectrics using ultrafast lasers”的長篇綜述文章，全文分為 6 章，14 個大圖，共約 18000 字。該論文以“光與物質相互作用”中的“物質”（包括透明電介質、半導體和晶體等）為重點，對近二十年來超快鐳射誘導納米光柵的形成機理進行了介紹與討論，並在基於材料化學組分的基礎上對其週期性、納米孔尺寸、填充因數以及相關的“光學性能”（納米光柵形成的起始 / 破壞的能量視窗、最大延遲量或者雙折射)和“技術性能”(誘導納米光柵的能量消耗、鐳射掃描速度以及熱穩定性 ）進行了分析與總結。



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https://doi.org/10.1364/OE.488249
https://doi.org/10.1016/j.pmatsci.2023.101226

Prof. Ren Wei Publishes Findings On Two-Dimensional Multiferroic Quantum Materials In “Physical Review Letters”

理學院 / 錢偉長學院任偉教授在《Physical Review Letters》期刊發表二維多鐵性量子材料成果

This work, driven by the expected contributions of two-dimensional multiferroic systems with strong magnetoelectric coupling to the development of multifunctional nanodevices, proposes vanadium halides VX2 (X = Cl, Br, I) monolayers as a class of spin-chirality-driven van der Waals multiferroic materials based on first-principles calculations. The triangular lattice’s magnetic ground state has a 120-degree spin-frustrated configuration that causes ferroelectric polarization through the breaking of spatial inversion symmetry, allowing control of polarization by manipulating spin chirality.

Applying an electric field perpendicular to the monolayer can stabilize one spin chirality over another, enabling electrical control of the spin configuration. The polarization direction is always perpendicular to the plane of the spin helix, suggesting that spin orientation can control the polarization direction. Moreover, generalized spin current theory indicates that ferroelectric polarization primarily arises from magnetic-electric interactions among first-neighbor spins. By using the spin current model, the study derived a magnetic-electric interaction matrix, showing polarization values consistent with those obtained from modern polarization theory.

The research also found that the magnetoelectric interaction in vanadium halides is significantly influenced by lattice constants and atomic distances, suggesting that even systems with weak spin-orbit coupling can exhibit strong magnetoelectric coupling. Although these three compounds show interlayer antiferromagnetic coupling, the spin chirality of each layer remains consistent, indicating that spin-induced polarization could also occur in the three-dimensional bulk form. The study predicts substantial spin-driven ionic displacements, leading to higher and more practical levels of polarization. This theoretical analysis of the unique magnetoelectric coupling in vanadium halides might catalyze the development of next-generation magnetoelectric devices.

本工作中利用第一性原理計算，研究了過渡金屬釩的鹵化物 VX2（X=Cl、Br、I）單層作為一類自旋手性驅動的范德華多鐵材料。其磁性原子為三角格子的排列方式，磁基態為 120 度自旋阻挫的構型，由於自旋相互作用打破空間反演對稱性會產生鐵電極化，可通過改變自旋手性控制鐵電極化的反轉。因而在施加垂直于單層的電場的情況下，一種自旋手性可以比另一種自旋手性構型穩定，從而實現自旋構型的電控制。研究發現極化方向始終垂直於自旋螺旋的平面，因此也可以通過控制自旋方向來調節極化方向。此外，通過廣義自旋流理論，該工作表明鐵電極化主要源于第一最近鄰的磁電相互作用，利用自旋流模型計算出磁電相互作用矩陣，得到的極化強度與現代極化理論的結果相當。研究還發現鹵化釩中的磁電相互作用受到晶格常數和原子距離的顯著影響，因此原則上能使弱自旋軌道耦合的系統表現出更強的磁電耦合作用。此外，雖然這三種化合物顯示層間反鐵磁耦合，但並不改變每層的自旋手性排列，因此在其三維塊體中也能發現自旋誘導的電極化。最後，該工作預測了顯著的自旋驅動離子位移，能夠獲得更大的較為實用的極化強度。本研究通過理論展示鹵化釩奇特的磁電耦合將有望促進下一代磁電器件的發展進步。


PHYSICAL REVIEW LETTERS
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Spin-Chirality-Driven Multiferroicity in van der Waals Monolayers
Chao Liu, Wei Ren, and Silvia Picozzi
Phys. Rev. Lett. 132, 086802 – Published 23 February 2024

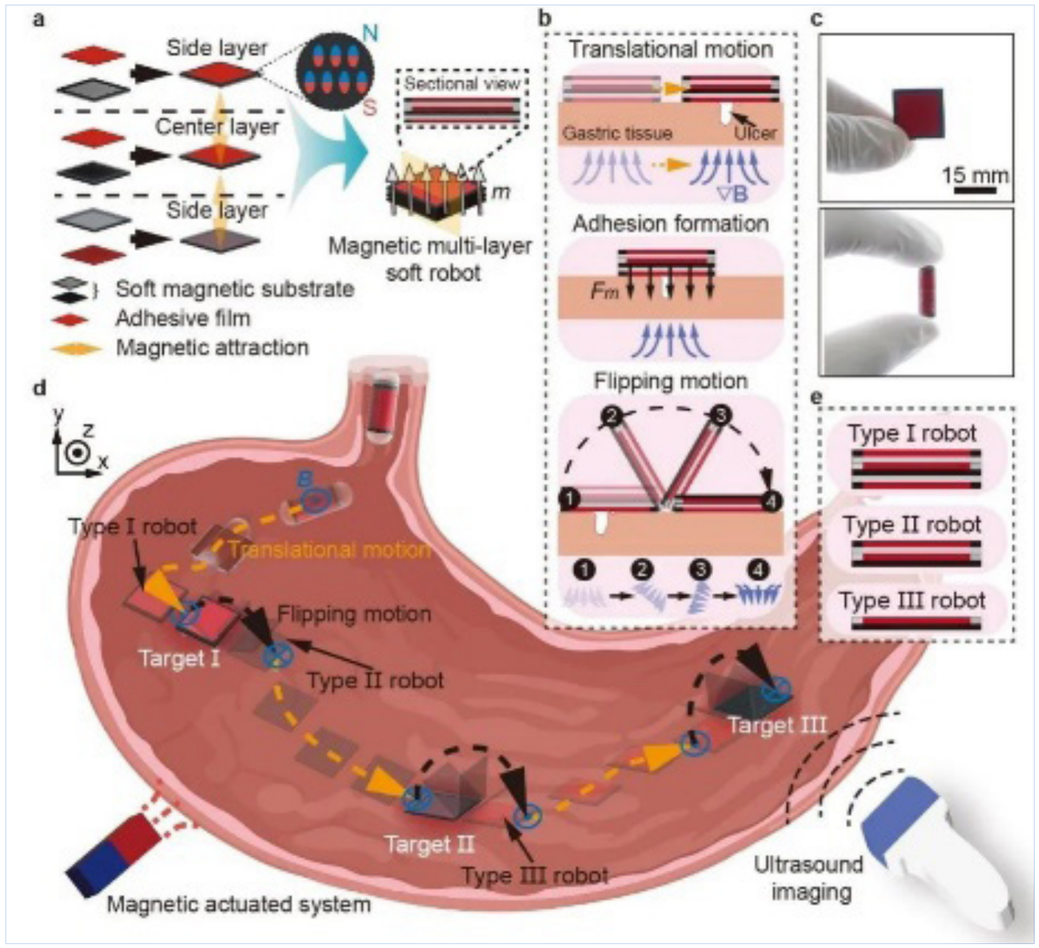
Article Link: https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.132.086802

Liu Na's Team Publishes Latest Findings In "Nature Communications"

機自學院劉娜副研究員課題組在《Nature Communications》期刊發表最新研究成果

The research group led by Associate Researcher Liu Na from the School of Mechatronics Engineering and Automation, in collaboration with Assistant Professor Yu Jiangfan from the Chinese University of Hong Kong, Shenzhen, has published a paper in "Nature Communications" titled "A Magnetic Multi-Layer Soft Robot for On-Demand Targeted Adhesion."

Magnetic soft robots hold great promise for biomedical applications due to their flexibility and reconfigurable shapes. They can enter human organs in a non-invasive manner to perform surgeries or deliver drugs under the guidance of external magnetic fields. This study explores the potential of multi-layer magnetic soft robots, which can offer greater loading capacity and functional complexity. The challenge of constructing a multi-layer magnetic soft robot with on-demand motion modes is addressed by tailoring the magnetic interaction between layers and designing each layer with distinct in-plane structures.



The team developed a magnetic multi-layer soft robot with three layers: a center layer and two side layers, each consisting of a soft magnetic substrate and an adhesive film. The robot can self-assemble into a multi-layer structure under magnetic attraction and can be curled into an edible capsule for easier delivery into the gastrointestinal tract. It can change shape and detach its layers on demand under magnetic field control, allowing for targeted adhesion at specific sites in biological tissues. The robot's capabilities are demonstrated in various configurations, as shown in Figure 1: Figure 1a shows the self-assembly process into a multi-layer structure, Figure 1b illustrates the robot's shape change and on-demand detachment under magnetic field control, and Figure 1c displays the robot's ability to curl into an edible capsule for easier delivery. The on-demand separation and adhesion features were validated on a live pig's stomach.

機自學院劉娜副研究員課題組和香港中文大學（深圳）俞江帆助理教授合作，在《Nature Communications》期刊發表題為"A magnetic multi-layer soft robot for on-demand targeted adhesion"的研究論文。

磁性軟體機器人由於其尺度優勢和柔順性，可以作為醫療機器人以無創的方式在外部磁場的驅動下進入人體器官執行手術或者遞送藥物。目前，研究人員已經開發出可以實現多模態多環境運動的磁性軟體機器人，並且與功能材料的結合使其在生物醫學應用中顯示出巨大的潛力。特別是具有多層結構的磁性軟機器人可以進一步提高藥物的裝載能力和功能的多樣性成為當前的研究熱點，但層與層之間的相互作用尚未得到充分研究，要實現具有按需運動模式的磁性多層軟體機器人仍然面臨相當大的挑戰。

對此，研究組通過研究並調控材料介面和層與層之間的磁相互作用，設計並製備了一種磁性多層軟體機器人（圖 1）：該機器人具三層結構，每層結構包括一個軟磁性基底和一個粘附膜，可在磁吸引的作用下層結構自組裝成磁性多層軟體機器人（圖 1a），並且夠被輕易的捲曲置入可食用膠囊內（圖 1c），在磁場控制下實現形態變化和層結構間的按需脫離（圖 1b）；該機器人的多靶點按需貼附功能在活體豬胃上得到了驗證。

Article Link:
Nat Commun. 2024 Jan 20;15(1):644. doi: 10.1038/s41467-024-44995-9. PMID: 38245517; PMCID: PMC10799857.

Research Team Led By Li Zhongjie And Peng Yan Publishes Advances In Improving Output Performance Of Triboelectric Nanogenerators In "Energy & Environmental Science"

機自學院李忠傑、彭豔團隊在《Energy & Environmental Science》發表提高摩擦電納米發電機輸出性能的研究進展

In recent years, with the integration of various technologies, triboelectric nanogenerators (TENG), based on triboelectric effects and electrostatic induction, have been widely used in various energy supply fields, reducing humanity's dependence on traditional energy sources like batteries. At this stage, TENG technology shows immense potential in energy harvesting and sensing applications. With advances in material synthesis and processing techniques, researchers have improved the output performance of TENG through unique structural designs. This review summarizes recent advances in improving TENG output performance through various strategies (Figure 1). It focuses on three main aspects: surface material modification, mechanical design, and power management.

The review systematically categorizes different strategies for improving TENG output performance. It first explores the selection and processing methods for TENG surface materials. Depending on the treatment method, surface material modification falls into two categories: physical modification and chemical modification. The review then discusses the use of high-performance biodegradable materials to improve TENG output performance, including cellulose-based materials, synthetic polymers, and bio-based materials.

Additionally, the review highlights advances in mechanical design to enhance output performance. Representative studies from the perspective of circuit management, including mechanical and electronic switches, are also discussed. Finally, the review provides a brief overview of the challenges and prospects in research focused on improving TENG output performance.

圖 1：提高 TENG 設備輸出性能的方法分類和應用示意圖

近年來，隨著各領域技術的融合，基於摩擦起電效應和靜電感應的摩擦納米發電機（TENG）已廣泛應用於各種能源供應領域，減少了人類對電池等傳統能源的依賴。現階段，TENG 技術在能量收集和傳感等各個領域都顯示出巨大的潛力。隨著材料合成和加工工藝的進步，研究人員通過各種獨特的結構設計提高 TENG 的輸出性能。本篇綜述總結了不同策略提高 TENG 輸出性能的研究進展（圖 1），主要內容包括三個方面 : 表面材料改性、機械設計以及電源管理。

本綜述系統地總結了基於不同策略提高 TENG 輸出性能的研究進展。首先，對 TENG 的表面材料選擇和處理方法進行了分類。根據處理方法的不同，表面材料的改性方法分為物理改性和化學改性。其次，考慮了通過製備高性能生物降解材料來提高 TENGs 的輸出性能，包括纖維素基材料、人造高分子材料和生物基材料。然後，總結了基於不同機械設計提高輸出性能的研究進展。此外，從電路開關 (包括機械和電子開關) 的角度介紹電路管理的代表性研究。最後，簡要概述了 TENG 在提升輸出性能的研究中所面臨的挑戰和發展前景。

> Article Link:
> https://pubs.rsc.org/en/content/articlelanding/2024/ee/d3ee03520d

Prof. Hairun Guo's Team Publishes Research In "Photonics Research"

通信學院郭海潤教授團隊在《Photonics Research》期刊發表研究成果

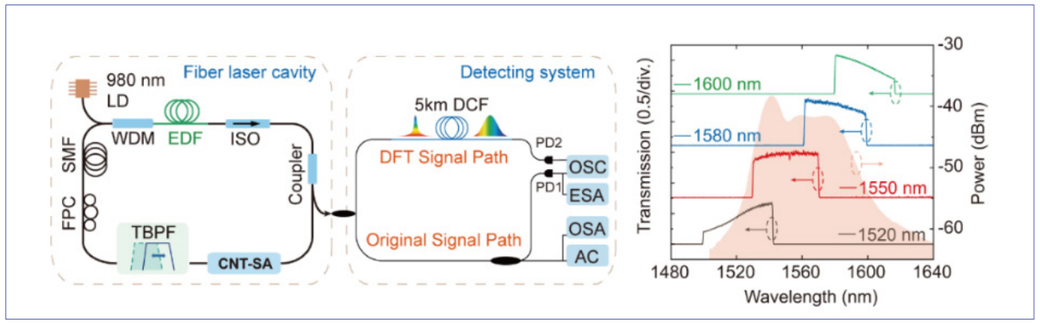
Professor Hairun Guo's team from the School of Communication and Information Engineering, in collaboration with domestic and international partners, published research in the international optics journal "Photonics Research" with the title "Universal dynamics and deterministic motion control of decoherently seeded temporal dissipative solitons via spectral filtering effect."

As modern technology continues to advance, laser technology is playing an increasingly significant role. Ultrafast laser pulses with short durations and high repetition rates have tremendous application potential in fields such as optical communications, optical sensing, and laser measurement. Temporal dissipative solitons are key mechanism for generating such pulsed lasers. These stable optical solitons arise from the balance between gain and loss, nonlinearity, and dispersion in optical resonators, offering a rich set of dynamic characteristics. Temporal dissipative solitons have been observed across various laser systems with different structures, scales, and media. Understanding their formation and dynamic behavior has become a crucial research area in ultrafast laser technology.

In this context, the team systematically studied the mechanisms for controlling dissipative solitons in ultrafast laser systems. Particularly in systems with decoherent excitation, where the pump light source does not directly convert into pulsed laser, making it challenging to control the state of dissipative solitons. To achieve active control over the soliton states, the team introduced the spectral filtering effect into ultrafast laser systems. By incorporating a tunable spectral filter, they could quantitatively control the optical gain in the cavity, allowing them to actively alter the dual balance conditions of dissipative solitons and therefore coherently control the soliton states.

通信與資訊工程學院郭海潤教授團隊聯合國內外合作者，在國際光學領域著名期刊《Photonics Research》發表題為"Universal dynamics and deterministic motion control of de-coherently seeded temporal dissipative solitons via spectral filtering effect"的研究成果。

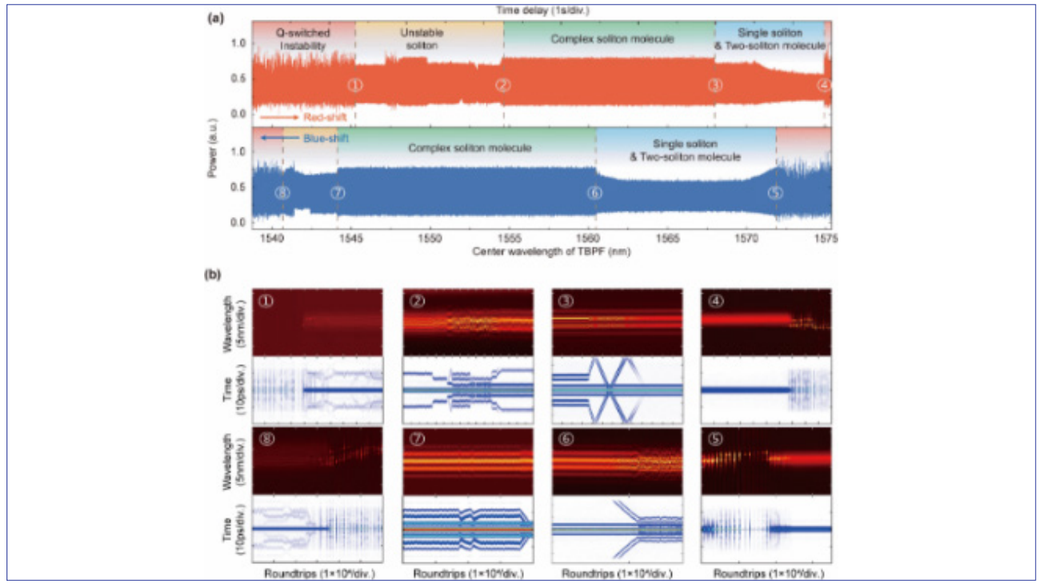
在現代科技發展進程中，雷射技術正在發揮愈發重要的作用。特別是持續時間短、重複頻率高的超短超快雷射脈衝，在光通信、光傳感、鐳射測量等領域有著巨大的應用價值。時域耗散孤子是產生此類脈衝式鐳射的主要工作機制，其本質上是光學諧振腔中由



Experimental setup and transmission spectrum of the tunable spectral filter
實驗系統圖以及可調諧光譜濾波器的透射譜圖

於增益與損耗、非線性與色散之間達成了雙重平衡而產生的一種穩定的光場形態，包涵豐富的動力學特性，至今已在不同結構、不同尺度、不同介質的各類鐳射系統中獲得驗證。探究時域耗散孤子的形成過程及其動力學規律，亦成為超快鐳射領域的重要研究課題。

在此背景下，團隊系統性地開展了超快鐳射系統中的耗散孤子調控機理研究。特別是在非相干激勵的系統中，泵浦光源並非直接轉換為脈衝式鐳射，因此難以直接調控耗散孤子的狀態。為了實現對孤子狀態的主動調控，團隊提出在超快鐳射系統中引入光譜濾波效應，通過設置可調諧的光譜濾波器，實現對腔內光學增益的量化調控，進而主動改變耗散孤子的雙平衡條件，實現對孤子狀態的相干調控。



Dynamic evolution of the formation and transformation of temporal dissipative solitons during spectral filtering
全過程的時域耗散孤子形成與演變動態

Article Link:
https://doi.org/10.1364/PRJ.500126

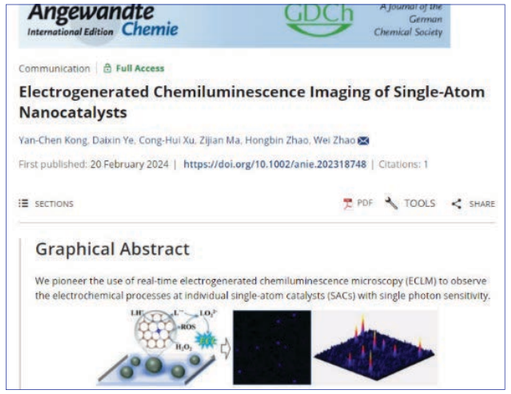
Prof. Zhao Wei’s Team Publishes New Research In “Angewandte Chemie International Edition”

環化學院趙微教授團隊在《Angewandte Chemie International Edition》期刊發表最新研究成果

The capacity to perform precise measurements at the molecular and atomic scales has transcended the boundaries between macroscopic and microscopic realms, enabling a more profound comprehension of molecular arrangements and large-scale phenomena, thereby illuminating the underlying principles of nature. Acquiring insights into the dynamics of fundamental chemical processes at the microscopic level is pivotal for theoretical investigations in both chemistry and physics, as well as for applications spanning multidisciplinary domains. The precise capture of exceedingly faint signals within minute spaces presents substantial challenges to both temporal and spatial resolution in electrochemical imaging and measurement.

Based on previous research, Professor Zhao Wei’s team has devised an ultraprecise electrogenerated chemiluminescence (ECL) imaging technique tailored for the screening of electron transfer processes at the interface of single-atom catalysts. This innovative method, termed electrochemiluminescence microscopy (ECLM), surpasses scanning electrochemical microscopy in terms of both temporal resolution and detection throughput. During potential step and cyclic voltammetry experiments, ECLM captures electron transfer signals at single-particle interfaces with a time resolution of 100 milliseconds and single-photon sensitivity.

For the first time, the researchers have introduced photon flux density into ECL imaging to quantify the electrocatalytic reaction efficiency of individual nanoparticles. This work unveils the intricate relationship between the components of single-atom metal catalysts and their catalytic abilities, furnishing invaluable theoretical insights and practical guidelines for comprehending catalytic reaction mechanisms and designing of highly efficient electrocatalysts.



在分子、原子水準開展精准測量，突破了從宏觀到微觀的界限，使人們對分子的集合和宏觀上的現象有更加深入的理解，從而瞭解自然界的本質。深入理解微觀層面基本化學過程發生的動力學特性，對於化學、物理規律的理論研究，以及多學科領域的應用實踐都具有重要意義。在極微小的空間內對於極其微弱的信號開展精准捕捉對成像與測量的時間和空間解析度提出了極大的挑戰。

在前期研究的基礎上，趙微教授團隊發展了超靈敏電致化學發光（ECL）成像方法，針對單原子催化劑介面電子轉移過程開展精准測量。相較於掃描電化學顯微鏡，電致化學發光顯微鏡（ECLM）具有更高的時間解析度和檢測通量。在電勢階躍及迴圈掃描過程中，ECLM 以百毫秒的時間解析度和單光子級靈敏度快速獲取單顆粒介面的電子轉移過程資訊。作者首次在 ECL 成像中引入光子通量密度概念，通過成像量化單個粒子的電催化反應效率，揭示了不同金屬單原子催化劑與其催化活性之間的關係，為深入理解催化反應機理和設計高效催化劑提供了重要的理論參考和實踐依據。

Article Link:
https://doi.org/10.1002/anie.202318748

Prof. Cao Guixin's Research Group Collaborates with Fudan University to Publish Research in "Advanced Materials"

材料基因院曹桂新教授團隊與復旦大學合作在《Advanced Materials》期刊發表研究成果

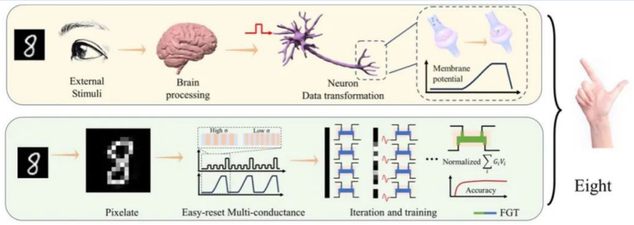


Figure: FGT-based Magnetic Synapse and Comparison with Human Brain Handwritten Image Recognition
基於 FGT 的磁突觸示意圖與人腦對手寫圖像識別的比較

Professor Cao Guixin's research group from the Materials Genome Institute, in collaboration with Professor Che Renchao's team from Fudan University, published a research paper in "Advanced Materials" titled "Current-Controllable and Reversible Multi-Resistance-State based on Domain Wall Number Transition in 2D Ferromagnet Fe3GeTe2." This study introduces an innovative all-electric control strategy that allows multi-state switching in the 2D ferromagnet Fe3GeTe2 by adjusting the number of domain walls to manipulate resistance values.

In-situ Lorentz transmission electron microscopy reveals a strong correlation between domain wall reduction and a corresponding decrease in resistance. The study also found that a single pulse current with higher amplitude can instantly reverse the magnetic state back to a multi-domain wall configuration, possibly due to rapid thermal demagnetization, as supported by simulation data. The ability to control resistance through domain wall modulation enables this FGT-based system to mimic the potentiation and depression processes observed in biological synapses.

The FGT-based neuromorphic computing system, which employs artificial synapses with multi-state switching, achieved an accuracy of about 91% in handwriting image recognition. This research highlights the potential of 2D ferromagnets for use in magnetic racetrack memories, topological devices, and neuromorphic computing devices, presenting new opportunities for advanced spintronic applications.

材料基因組工程研究院曹桂新教授團隊與復旦大學車仁超教授團隊合作在《Advanced Materials》期刊發表題為"Current-Controllable and Reversible Multi-Resistance-State based on Domain Wall Number Transition in 2D Ferromagnet Fe3GeTe2"的研究論文。本研究提出了一種獨特的全電控制策略，通過電流控制 Fe3GeTe2（FGT）中的磁疇壁數量和電阻值變化來實現多態切換。原位洛倫茲透射電鏡揭示了電阻和疇壁數之間的強相關性，隨著疇壁數的減少，電阻值也同步下降。研究還發現，脈衝電流能夠可逆地切換磁疇壁狀態，表明在 FGT 中可以通過全電方式可控和可逆地操縱疇壁數量和電阻。基於 FGT 的神經網路可逆突觸設備利用調節磁疇壁數量和相應的多態切換模擬了生物突觸的工作過程，實現了約 91% 的準確率。這一成果為發展基於二維鐵磁體的高回應速度、易於重置和高準確性的神經形態計算設備提供了新的可能。

Article Link:
https://doi.org/10.1002/adma.202311831

Prof. Zhang Tong-Yi And Prof. Sun Sheng Published A New Research In "International Journal Of Mechanical Sciences"

材料基因院張統一院士和孫升研究員在《International Journal of Mechanical Sciences》期刊發表最新研究成果

The research group led by Prof. ZHANG Tong-Yi, who is an Academician of China, and Professor SUN, Sheng published their latest research in the journal "International Journal of Mechanical Sciences". The title of the paper is "Machine learning-assisted shape morphing design for soft smart beam" (267:108957, 2024).

This research is inspired by the complex patterns that emerge from the simple interactions within animal herds. It details a novel method to induce on-demand deformations in dielectric elastomers via multi-point actuation. By integrating finite element simulations of mechanical-electrical couplings, neural network surrogate models, and heuristic algorithms, the study offers a sophisticated, data-driven methodology for tailoring the actuation profiles of soft robots to specific excitations. This approach promises enhanced precision and adaptability in the design and operation of soft robotic systems.

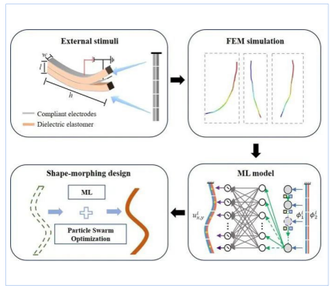


Figure 1 Data-Driven Framework for Reverse Design of Actuation Shape of a Dielectric Flexible
圖 1. 介電柔性梁的致動形狀逆向設計資料驅動框架 Beam.

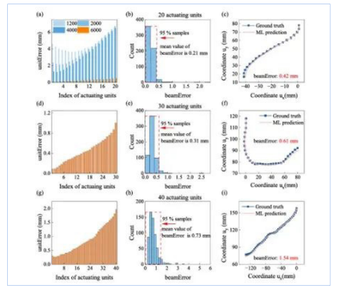


Figure 2 Predictions from the LSTM-FCNN Model for Dielectric Flexible Beams of 80mm, 120mm, and 160mm Lengths
圖 2：LSTM-FCNN 模型對長度為 80mm、120mm 和 160mm 介電柔性梁的預測結果

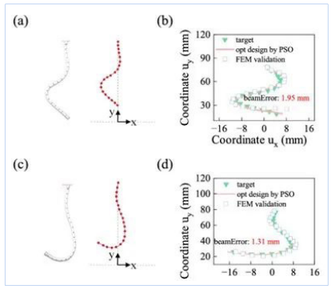


Figure 3 Reverse Design Results of Actuation Deformation for Manually Configured Dielectric Flexible Beams
圖 3：人為擺出的介電柔性梁的致動變形逆向設計結果

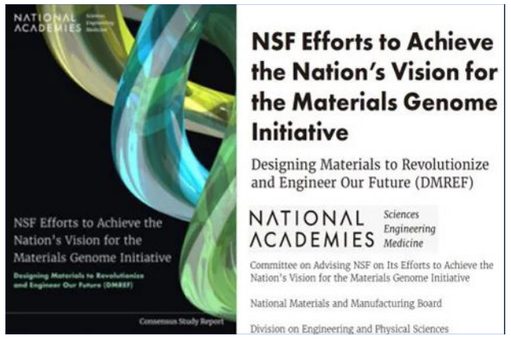
張統一院士和孫升研究員課題組在機械工程領域期刊《International Journal of Mechanical Sciences》發表了機器學習輔助軟體機器人設計的最新研究成果（Machine learning-assisted shape morphing design for soft smart beam，267:108957，2024）。

本工作借鑒自然界中獸群通過單體相互作用實現宏觀"湧現"能力的現象，提出多點激勵實現介電彈性體按需變形的方法，通過融合力電耦合大變形有限元類比、神經網路代理模型和啟發式演算法，提出了確定軟體機器人目標致動形狀外加激勵的資料驅動方法。

Article Link:
https://doi.org/10.1016/j.ijmecsci.2023.108957

The American National Science Foundation Highlights Shanghai University's Materials Genome Institute In Ten-Year Mgi Report

材料基因院在美國國家科學基金會（NSF）材料基因組工程十年總結中被大篇幅報導



The American National Science Foundation (NSF) has recently published a report assessing the advancements of the Materials Genome Initiative (MGI) over the past decade (DOI: 10.17226/26723). Entitled "NSF Efforts to Achieve the Nation's Vision for the Materials Genome Initiative: Designing Materials to Revolutionize and Engineer Our Future", the document underscores the NSF's pivotal role in propelling the MGI forward in 2023. Notably, the report dedicates a substantial segment to the development of materials genome engineering in China, with particular emphasis on the contributions of the Materials Genome Institute at Shanghai University, cataloging its significant achievements and endeavors.

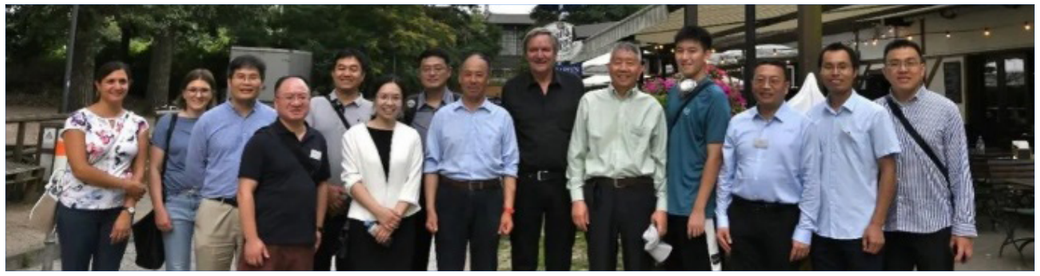
This recent NSF report serves as a testament to the prominence of the Materials Genome Institute at Shanghai University, which was also featured prominently in a 2021 Nature article, "Speed-sifting data for the next big thing" (Nature, 2021, 595, pp836). The article praised the institute for its construction and broad international collaborations.

The institute has continued to extend its international reach, exemplified by a recent visit to the Max Planck Institute in Germany.

近日，美國國家科學基金會（NSF）發佈了對材料基因組工程實施十周年的展望報告（DOI: 10.17226/26723），報告題目為《NSF Efforts to Achieve the Nation's Vision for the Materials Genome Initiative: Designing Materials to Revolutionize and Engineer Our Future》（國家科學基金會為實現國家材料基因組計畫願景所做的努力：設計材料以革新和工程化我們的未來）(2023)。報告在講到中國材料基因組工程發展的內容部分，有近八成篇幅是介紹上海大學材料基因組工程研究院的。

美國國家科學基金會 NSF 的這一報告，是上海大學材料基因組工程研究院繼 2021 年 Nature 期刊在《Speed-sifting data for next big thing》(Nature, 2021, 595, pp836）專題報導中世界科學界的又一次重要報導，在 Nature 這篇文章中特別提及上海大學材料基因組工程研究院的建設情況和廣泛的國際合作。

上海大學材料基因組科研團隊訪問德國馬普弗裡茲哈伯研究所



Prof. Chen Liang Publishes Original Research In Nature's Subsidiary Journal

醫學院陳亮教授在 Nature 子刊發表原創性論文

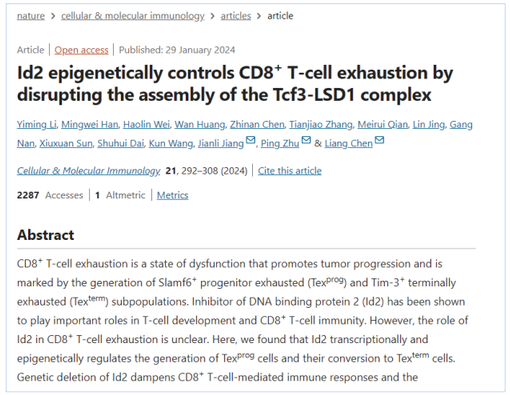
Professor Chen Liang's team, in collaboration with Professor Zhu Ping's team from the First Affiliated Hospital of Air Force Medical University and Researcher Jiang Jianli's team from the Institute of Cell Biology and National Center for Translational Medicine, published a paper titled "Id2 epigenetically controls CD8+ T-cell exhaustion by disrupting the assembly of the Tcf3-LSD1 complex" in "Cellular & Molecular Immunology," a journal under Nature with an impact factor of 24.1. This research uncovers a novel mechanism through which Id2 controls CD8+ T-cell exhaustion, shedding light on its role in inhibiting tumor immune escape.

The study used gene-modified mouse models to show that Id2 boosts the cytotoxicity of CD8+ T cells against tumor cells. It was observed that Id2 regulates the generation of Slamf6+ progenitor exhausted (Texprog) cells and their transformation into Tim-3+ terminally exhausted (Texterm) cells, which play a role in suppressing tumor immune evasion. Mechanistically, Id2 disrupts the assembly of the Tcf3-LSD1 transcriptional regulatory complex, preventing LSD1 (lysine-specific demethylase) from demethylating the key gene Slamf6-associated chromatin histone H3K4me2, thus altering chromatin accessibility in CD8+ T cells.

This study is the first to report Id2 as an epigenetic regulator in the immune system, demonstrating its role in enhancing CD8+ T-cell antitumor immune response and inhibiting tumor immune escape.

陳亮教授團隊與空軍軍醫大學第一附屬醫院朱平教授團隊、基礎醫學院細胞生物學教研室 / 國家分子醫學轉化中心蔣建利研究員團隊合作在 Nature 旗下的 Cellular & Molecular Immunology 雜誌（IF：24.1）上發表了題為"Id2 epigenetically controls CD8+ T-cell exhaustion by disrupting the assembly of the Tcf3-LSD1 complex"的研究論文。該研究揭示了 Id2 调控 CD8+ T 細胞耗竭抑制腫瘤免疫逃逸的新型分子機制。

研究通過構建多種基因修飾小鼠模型，從分子、細胞和動物模型等多個層面，發現 Id2 能夠促進 CD8+T 細胞對腫瘤細胞的殺傷，調控干细胞样耗竭 CD8+ T 細胞與終末耗竭 CD8+ T 細胞的形成，抑制腫瘤免疫逃逸。機制方面，Id2 抑制 Tcf3-LSD1 轉錄調控複合體的組裝，從而抑制組蛋白賴氨酸特異性去甲基化酶 LSD1 對 T 細胞耗竭關鍵基因 Slamf6 相關染色質組蛋白 H3K4me2 去修飾，重塑 CD8+ T 細胞的染色質開放性。本研究首次報導了 Id2 作為免疫系統表觀遺傳調控因素，增強 CD8+ T 細胞抗腫瘤免疫應答，抑制腫瘤免疫逃逸。



nature > cellular & molecular immunology > articles > article

Article | Open access | Published: 29 January 2024

Id2 epigenetically controls CD8⁺ T-cell exhaustion by disrupting the assembly of the Tcf3-LSD1 complex

Yiming Li, Mingwei Han, Haolin Wei, Wan Huang, Zhinan Chen, Tianjiao Zhang, Meirui Qian, Lin Jing, Gang Nan, Xiuxuan Sun, Shuhui Dai, Kun Wang, Jianli Jiang, Ping Zhu & Liang Chen

Cellular & Molecular Immunology **21**, 292–308 (2024) | Cite this article

2287 Accesses | 1 Altmetric | Metrics

Abstract

CD8⁺ T-cell exhaustion is a state of dysfunction that promotes tumor progression and is marked by the generation of Slamf6⁺ progenitor exhausted (Tex^{prog}) and Tim-3⁺ terminally exhausted (Tex^{term}) subpopulations. Inhibitor of DNA binding protein 2 (Id2) has been shown to play important roles in T-cell development and CD8⁺ T-cell immunity. However, the role of Id2 in CD8⁺ T-cell exhaustion is unclear. Here, we found that Id2 transcriptionally and epigenetically regulates the generation of Tex^{prog} cells and their conversion to Tex^{term} cells. Genetic deletion of Id2 dampens CD8⁺ T-cell-mediated immune responses and the

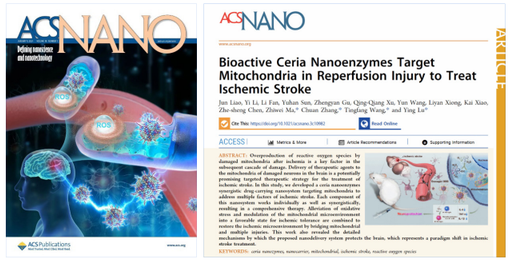
Article Link:
https://www.nature.com/articles/s41423-023-01118-6

Prof. Zhang Chuan's Team Publishes Multiple Significant Research Findings In Acs Nano And Other Leading Journals

醫學院張川教授團隊在 ACS NANO 等權威期刊發表多項重要研究成果

(1) Bioactive Cerium Nanozyme Targets Mitochondria in Reperfusion Injury for Ischemic Stroke

This study addresses the oxidative stress microenvironment and inflammatory microenvironment in ischemic stroke. It introduces the concept of "mitochondrial microenvironment regulation" for ischemic stroke and designs a mitochondrial-targeted drug-loaded cerium oxide nanozyme delivery system. The bioactivity, pharmacodynamics in vitro and in vivo, and mechanism of action of the system were comprehensively and systematically studied. By implementing a reasonable "mitochondrial microenvironment remodeling" strategy, it indirectly regulates the ischemic microenvironment to achieve optimal therapeutic effects, while exploring possible mechanisms. This approach can help overcome current therapeutic bottlenecks, offering new approaches for the safe and effective treatment of ischemic stroke.



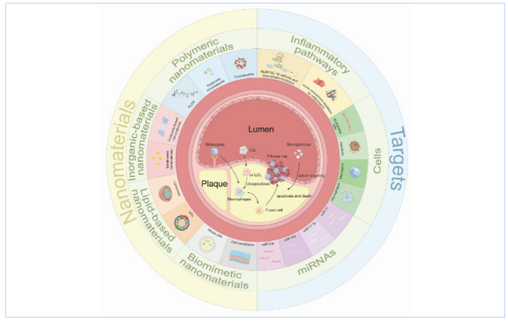
Article Link: https://doi.org/10.1021/acsnano.3c10982

(1) 生物活性鈰納米酶瞄準再灌注損傷中的線粒體治療缺血性腦卒中

該研究針對缺血性腦卒中氧化應激微環境和炎症微環境。提出了針對缺血性腦卒中的"線粒體微環境調控"理念，設計和構建了線粒體靶向的氧化鈰載藥納米酶遞送系統，對它們的生物活性、體內外藥效學和作用機制進行了全面而系統研究，通過合理的"線粒體微環境重塑"策略間接調控缺血微環境以期獲得最佳的治療效果，並探索其可能機制，將有利於突破現有的治療瓶頸，為缺血性腦卒中的安全有效治療提供新的思路。

(2) Recent Advances in Anti-Atherosclerosis and Potential Therapeutic Targets for Nanomaterial-Derived Drug Formulations

This review provides a comprehensive summary of the pathological mechanisms underlying atherosclerosis, nanoparticle-mediated therapeutic approaches, and potential future targets for nanodelivery. It explores the potential and challenges of using nanoparticles for atherosclerosis treatment while emphasizing new and effective design strategies.



（2）納米粒子介導動脈粥樣硬化的病理機制及靶向治療策略

該研究綜述對動脈粥樣硬化的病理機制，納米顆粒介導的治療策略，以及未來納米遞送的潛在治療靶點進行了系統總結。揭示了納米顆粒用於動脈粥樣硬化治療的潛力和挑戰，並強調了新的有效的設計思路。

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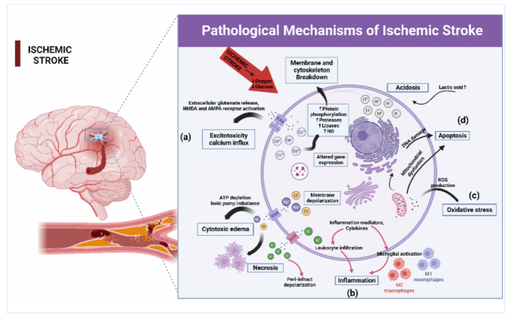

(3) Advanced nano drug delivery systems for neuroprotection against ischemic stroke

This review explores advanced neuroprotective drug delivery systems to overcome the limitations of delivering neuroprotectants to the brain for ischemic stroke (IS) treatment. It discusses how pharmaceutical approaches can enhance the delivery of neuroprotectants to the brain and emphasizes the role of advanced delivery systems. Understanding these innovative delivery systems can pave the way for new strategies in IS treatment. These systems have the potential to optimize drug delivery, improve bioavailability, and enhance the efficacy of neuroprotectants in IS therapy. The review delves into the application of neuroprotectant-based advanced drug delivery systems (ADDSs) in IS therapy, exploring the potential and challenges in clinical application, and offering new ideas and perspectives for neuroprotective therapy for IS.


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Advanced nano drug delivery systems for neuroprotection against ischemic stroke
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ABSTRACT
Ischemic stroke (IS) represents a significant threat to brain health due to its elevated mortality and disability rates. The efficacy of small-molecule neuroprotective agents has been impeded by challenges associated with traversing the blood-brain barrier (BBB) and limited bioavailability. Conversely, advanced nano drug delivery systems hold promise for overcoming these obstacles by facilitating efficient transportation across the BBB and maintaining optimal drug concentrations. This review aims to explore advanced neuroprotective nano drug delivery systems as a means of effectively administering neuroprotective agents to the brain using pharmaceutical approaches in the treatment of IS. By examining these systems, researchers and clinicians can gain valuable insights and innovative concepts, illuminating the potential of advanced neuroprotective nano drug delivery systems. Leveraging these advancements can drive the progress of pioneering and efficacious therapeutic interventions for IS.

（3）基於缺血性腦卒中神經保護的先進納米遞送系統

該研究綜述深入探討了先進的神經保護性給藥系統，以克服將神經保護劑輸送到大腦用於 IS 治療的局限性。還探討了如何應用製藥方法加強向大腦輸送神經保護劑，並強調了先進給藥系統的作用。通過瞭解和利用這些創新給藥系統的能力，可以開發出治療 IS 的新策略。這些系統具有優化給藥方式、提高生物利用度和增強神經保護劑治療 IS 的療效的潛力。該綜述將重點討論基於神經保護劑的 ADDSs 在 IS 治療中的應用。此外，還討論了基於神經保護劑的先進藥物遞釋系統在臨床研究中應用的潛力和挑戰，旨在為 IS 神經保護治療提供新思路和新視角。

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Dr. Cong Wei Publishes Research In The “Journal Of Medicinal Chemistry”

醫學院青年教師叢薇博士在《Journal of Medicinal Chemistry》期刊發表研究成果

Dr. Cong Wei, a young faculty member at the School of Medicine, published a research paper in the “Journal of Medicinal Chemistry” titled “Design, Synthesis, and Anti-Osteoporotic Characterization of Arginine N-Glycosylated Teriparatide Analogs via the Silver-catalyzed Solid-Phase Glycosylation Strategy.”

In this study, the researchers used a silver-catalyzed solid-phase glycosylation (SSG) strategy to design and synthesize a series of peptides modified at Arg20 and/or Arg25. Among them, the analogs PTH-1g and PTH-2i demonstrated enhanced serum stability and significantly improved anti-osteoporotic activity both in vitro and in vivo, indicating their potential as candidate drugs for the effective treatment of osteoporosis.

醫學院青年教師叢薇博士在《Journal of Medicinal Chemistry》期刊發表了題為“Design, Synthesis, and Anti-Osteoporotic Characterization of Arginine N-Glycosylated Teriparatide Analogs via the Silver-catalyzed Solid-Phase Glycosylation Strategy”的研究論文。

本研究利用銀催化固相糖基化（SSG）策略設計並合成了以 Arg20 和 / 或 Arg25 為修飾位點的系列多肽。其中，PTH-1g 和 PTH-2i 血清穩定性增強，體外和體內抗骨質疏鬆活性顯著改善，可以作為有效治療骨質疏鬆症的候選藥物。

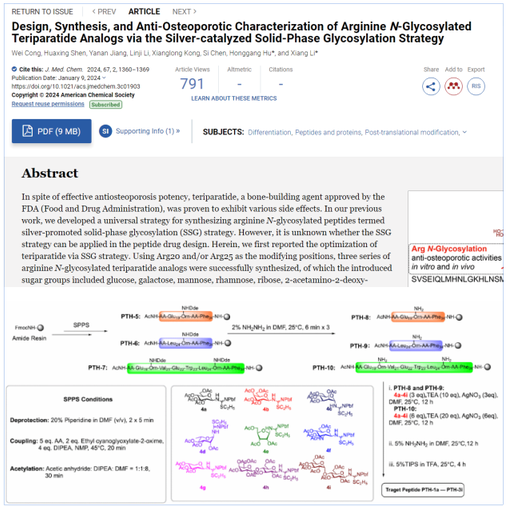

Figure 1 Synthesis Strategy for Arginine N-Glycosylated Teriparatide Analogs

圖 1 精氨酸 N- 糖基化特立帕肽類似物的合成策略

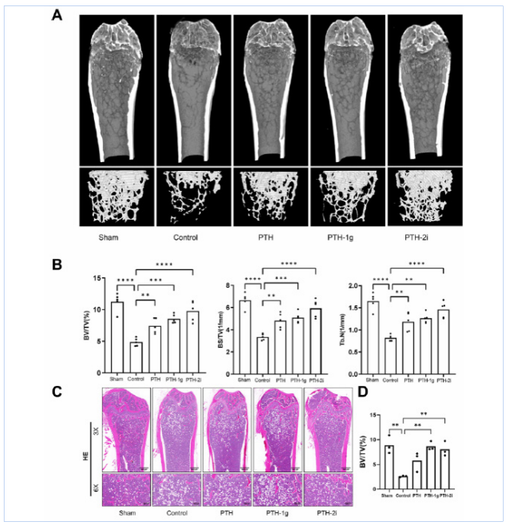

Figure 2 PTH-1g and PTH-2i Inhibit Osteoclast-mediated Bone Resorption In Vivo

圖 2 PTH-1g 和 PTH-2i 抑制體內破骨細胞介導的骨吸收

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