Science Newsletter

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Contents

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Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2024/0112/c5474a174724/page.htm. If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Mechanical Engineering**:
We post several papers which are related to the top concerned topics of researches on Mechanical Engineering. The papers are classified in 5 categories, and they are: **Precision mechanism, Mechatronic system, Adaptive Control, Mechanical transmissions** and **Optoelectronics**. Also, the listed papers are all arranged in a descending sort of JCR impact factor. If you want full pages of these papers, please contact us for help.

PRECISION MECHANISM

Mol Cancer (impact factor: 37.3) 1 区

Multi-omics profiling reveal cells with novel oncogenic cluster, TRAP1^{low}/CAMSAP3^{low}, emerge more aggressive behavior and poor-prognosis in early-stage endometrial cancer

Xiaodan Mao, Xiaoyue Tang, et. al

Abstract:
The clinical heterogeneity of early-stage endometrial cancer (EC) is worthy of further study to identify high-quality prognostic markers and their potential role in aggressive tumor behavior. Mutation of TP53 was considered as an important primary triage in modified molecular typing for EC, it still cannot precisely predict the prognosis of EC.

After proteomic analysis of cancer and para-cancerous tissues from 24 early-stage endometrioid EC patients with different survival outcomes, 13 differentially expressed proteins were screen out while 2 proteins enriched in p53 signaling pathway were further identified by single-cell transcriptome (scRNA-seq). Interestingly, tumor necrosis factor type-1 receptor-associated protein (TRAP1) and calmodulin-regulated spectrin-associated protein family member 3 (CAMSAP3) were found to be significantly downregulated in the specific cell cluster. Expectedly, the signature genes of $TRAP1^{low}$/$CAMSAP3^{low}$ cluster included classical oncogenes. Moreover, close cellular interactions were observed between myeloid cells and the $TRAP1^{low}$/$CAMSAP3^{low}$ cluster after systematically elucidating their relationship with tumor microenvironment (TME). The expression of TRAP1 and CAMSAP3 was verified by immunohistochemistry. Thus, a novel prediction model combining TRAP1, CAMSAP3 and TP53 was construct by multi-omics. Compared with the area under the curve, it demonstrated a significantly improvemrnt in the diagnostic efficacy in EC patients from TCGA bank. In conclusion, this work improved the current knowledge regarding the prognosis of early-stage EC through proteomics and scRNA-seq. These findings may lead to improvements in precise risk stratification of early-stage EC patients.

Cell Death Differ (impact factor: 12.4) 1 区 TOP

Regulation of primary cilia disassembly through HUWE1-mediated TTBK2 degradation plays a crucial role in cerebellar development and medulloblastoma growth.

Lin, Li, Chang, et. al

Abstract:

Development of the cerebellum requires precise regulation of granule neuron progenitor (GNP) proliferation. Although it is known that primary cilia are necessary to support GNP proliferation, the exact molecular mechanism governing primary cilia dynamics within GNPs remains elusive. Here, we establish the pivotal roles for the centrosomal kinase TTBK2 (Tau tubulin kinase-2) and the E3 ubiquitin ligase HUWE1 in GNP proliferation. We show that TTBK2 is highly expressed in proliferating GNPs under Sonic Hedgehog (SHH) signaling, coinciding with active GNP proliferation and the presence of primary cilia. TTBK2 stabilizes primary cilia by inhibiting their disassembly, thereby promoting GNP proliferation in response to SHH. Mechanistically, we identify HUWE1 as a novel centrosomal E3 ligase that facilitates primary cilia disassembly by targeting TTBK2 degradation. Disassembly of primary cilia serves as a trigger for GNP differentiation, allowing their migration from the external granule layer (EGL) of the cerebellum to the internal granule layer (IGL) for subsequent maturation. Moreover, we have established a link between TTBK2 and SHH-type medulloblastoma (SHH-MB), a tumor characterized by uncontrolled GNP proliferation. TTBK2 depletion inhibits SHH-MB proliferation, indicating that TTBK2 may be a potential therapeutic target for this cancer type. In summary, our findings

reveal the mechanism governing cerebellar development and highlight a potential anti-cancer strategy for SHH-MB.© 2024. The Author(s).

Biochim Biophys Acta Rev Cancer (impact factor: 11.2) 1 ☒ TOP

Dissecting SOX2 expression and function reveals an association with multiple signaling pathways during embryonic development and in cancer progression.

Niharika, Ureka, et. al

Abstract:

SRY (Sex Determining Region) box 2 (SOX2) is an essential transcription factor that plays crucial roles in activating genes involved in pre- and post-embryonic development, adult tissue homeostasis, and lineage specifications. SOX2 maintains the self-renewal property of stem cells and is involved in the generation of induced pluripotency stem cells. SOX2 protein contains a particular high-mobility group domain that enables SOX2 to achieve the capacity to participate in a broad variety of functions. The information about the involvement of SOX2 with gene regulatory elements, signaling networks, and microRNA is gradually emerging, and the higher expression of SOX2 is functionally relevant to various cancer types. SOX2 facilitates the oncogenic phenotype via cellular proliferation and enhancement of invasive tumor properties. Evidence are accumulating in favor of three dimensional (higher order) folding of chromatin and epigenetic control of the SOX2 gene by chromatin modifications, which implies that the expression level of SOX2 can be modulated by epigenetic regulatory mechanisms, specifically, via DNA methylation and histone H3 modification. In view of this, and to focus further insights into the roles SOX2 plays in physiological functions, involvement of SOX2 during development, precisely, the advances of our knowledge in pre- and post-embryonic development, and interactions of SOX2 in this scenario with various signaling pathways in tumor development and cancer progression, its potential as a therapeutic target against many cancers are summarized and discussed in this article.Copyright © 2024. Published by Elsevier B.V.

MECHATRONIC SYSTEM

Adv Sci (Weinh) (impact factor: 15.8) 1 ☒

Effective Charging of Commercial Lithium Cell by Triboelectric Nanogenerator with Ultrahigh Voltage Energy Management.

Abstract:
It is an increasingly mature application solution that triboelectric nanogenerator (TENG) supplies power to electronic devices through its power management system (PMS). However, the previous PMS is able to manage a limited voltage magnitude and the energy storage elements are limited to capacitors. This work proposes an ultrahigh voltage PMS (UV-PMS) to realize the charging of commercial lithium cells (LCs) by TENG. The design of UV-PMS enables energy management of TENGs with ultrahigh open-circuit voltages up to 3500 V and boosts the peak charging current from 30.9 μA to 2.77 mA, an increase of 89.64 times. With the introduction of UV-PMS, the effective charging capacity of LC charged by a TENG at a working frequency of 1.5 Hz for 1 h comes to 429.7 μAh, making a 75.3 times enhancement compared to charging by TENG directly. The maximum charging power comes to 1.56 mW. The energy storage efficiency is above 97% and the overall charge efficiency can be maintained at 81.2%. This work provides a reliable strategy for TENG to store energy in LC, and has promising applications in energy storage, LC's life, and self-powered systems.© 2024 The Author(s). Advanced Science published by Wiley‐VCH GmbH.

Chemosphere (impact factor: 8.8) 2 区 TOP

Modulating Nanostructures with Polyvinylpyrrolidone: Design and Development of a Porous, Biocompatible, and pH-Stable Core-Shell Magnetic Microrobot for Demonstrating Drug Absorption from Wastewater.

Murugan, Yang, et al

Abstract:
Increased antineoplastic drug concentrations in wastewater stem from ineffective treatment plants and increased usage. Although microrobots are promising for pollutant removal, they face hurdles in developing a superstructure with superior adsorption capabilities, biocompatibility, porosity, and pH stability. This study focused on adjusting the PVP concentration from 0.05 to 0.375 mM during synthesis to create a favorable CMOC structure for drug absorption. Lower PVP concentrations (0.05 mM) yielded a three-dimensional nanoflower structure of CaMoO4 and CuS nanostructures, whereas five-fold concentrations (0.25 mM) produced a porous structure with a dense CuS core encased in a transparent CaMoO4 shell. The magnetically movable and pH-stable COF@CMOC microrobot, achieved by attaching CMOC to cobalt ferrite (CoF) NPs, captured doxorubicin efficiently, with up to 57 % efficiency at 200 ng/mL concentration for 30 min, facilitated by electrostatic interaction, hydrogen bonding, and pore filling of DOX. The results demonstrated that DOX removal through magnetic motion showed superior performance, with an estimated improvement of 57% compared to stirring conditions (17 %). A prototype PDMS microchannel system was developed to study drug absorption and microrobot recovery. The CaMoO4 shell of the microrobots exhibited remarkable robustness, ensuring long-lasting functionality in harsh wastewater environments and improving biocompatibility while safeguarding the

CuS core from degradation. Therefore, microrobots are a promising eco-friendly solution for drug extraction. These microrobots show promise for the selective removal of doxorubicin from contaminated wastewater.Copyright © 2024. Published by Elsevier Ltd.

Comput Biol Med (impact factor: 7.7) 2 ☒

Deep orthogonal multi-wavelength fusion for tomogram-free diagnosis in diffuse optical imaging.

Ben Yedder, et. al

Abstract:

Novel portable diffuse optical tomography (DOT) devices for breast cancer lesions hold great promise for non-invasive, non-ionizing breast cancer screening. Critical to this capability is not just the identification of lesions but rather the complex problem of discriminating between malignant and benign lesions. To accurately reconstruct the highly heterogeneous tissue of a cancer lesion in healthy breast tissue using DOT, multiple wavelengths can be leveraged to maximize signal penetration while minimizing sensitivity to noise. However, these wavelength responses can overlap, capture common information, and correlate, potentially confounding reconstruction and downstream end tasks. We show that an orthogonal fusion loss regularizes multi-wavelength DOT leading to improved reconstruction and accuracy of end-to-end discrimination of malignant versus benign lesions. We further show that our raw-to-task model significantly reduces computational complexity without sacrificing accuracy, making it ideal for real-time throughput, desired in medical settings where handheld devices have severely restricted power budgets. Furthermore, our results indicate that image reconstruction is not necessary for unbiased classification of lesions with a balanced accuracy of 77% and 66% on the synthetic dataset and clinical dataset, respectively, using the raw-to-task model. Code is available at https://github.com/sfu-mial/FuseNet.Copyright © 2024 The Authors. Published by Elsevier Ltd.. All rights reserved.

ADAPTIVE CONTROL

Nat Commun (impact factor: 16.6) 1 ☒

Light regulates nuclear detainment of intron-retained transcripts through COP1-spliceosome to modulate photomorphogenesis

Hua Zhou, Haiyue Zeng, et. al

Abstract:
Intron retention (IR) is the most common alternative splicing event in Arabidopsis. An increasing number of studies have demonstrated the major role of IR in gene expression regulation. The impacts of IR on plant growth and development and response to environments remain underexplored. Here, we found that IR functions directly in gene expression regulation on a genome-wide scale through the detainment of intron-retained transcripts (IRTs) in the nucleus. Nuclear-retained IRTs can be kept away from translation through this mechanism. COP1-dependent light modulation of the IRTs of light signaling genes, such as PIF4, RVE1, and ABA3, contribute to seedling morphological development in response to changing light conditions. Furthermore, light-induced IR changes are under the control of the spliceosome, and in part through COP1-dependent ubiquitination and degradation of DCS1, a plant-specific spliceosomal component. Our data suggest that light regulates the activity of the spliceosome and the consequent IRT nucleus detainment to modulate photomorphogenesis through COP1.

Appetite (impact factor: 5.4) 2 ☒

Reward for fat and sweet dimensions of food are altered by an acute bout of running in healthy young men.

Yamada, Hiratsu, et. al

Abstract:
Acute moderate- to high-intensity exercise, primarily aerobic exercise, has been reported to decrease food reward in brain regions via the hedonic pathways and reduce preference for high-energy or high-fat foods. However, studies examining food reward responses to acute exercise have been limited to measuring food reward only after exercise and less frequently before and after exercise. Therefore, the changes in food reward in response to acute exercise remain unclear. This study investigated the effect of acute running on food reward in healthy young men. Fourteen young healthy men (mean ± standard deviation, age; 23 ± 2 years, body mass index; 21 ± 2 kg/m2) completed two trials (i.e., exercise and control) in a randomised, crossover design. Participants performed a 30-minute running bout at 70% of maximal oxygen uptake or sitting rest before and after food reward evaluation with a computer-based food choice behaviour task tool. Food reward was assessed for foods varying in fat content and sweet taste, and there were four assessment parameters: explicit liking, explicit wanting, implicit wanting and frequency of choice of each food category (relative preference). Explicit and implicit wanting, and relative preference for high-fat relative to low-fat foods were reduced after the exercise trial compared to the control trial (trial-by-time interaction, all $p \leqslant 0.02$). Implicit wanting and relative preference for sweet relative to savoury foods were increased after the exercise trial compared to the control trial (trial-by-time interaction, all $p \leqslant 0.003$). These findings indicate that moderate-intensity acute running alters the reward bias away from high fat towards low fat foods

and away from savoury towards sweet foods in healthy young men.Copyright © 2024. Published by Elsevier Ltd.

Pestic Biochem Physiol (impact factor: 4.7) 1 ☒

A novel spider venom peptide from the predatory mite Neoseiulus barkeri shows lethal effect on phytophagous pests.

Chen, Adang, et. al

Abstract:

The long-term use of pesticides in the field, and the high fertility and adaptability of phytophagous mites have led to resistance problems; consequently, novel safe and efficient active substances are necessary to broaden the tools of pest mite control. Natural enemies of arthropods typically secrete substances with paralytic or lethal effects on their prey, and those substances are a resource for future biopesticides. In this study, two putative venom peptide genes were identified in a parasitic mite Neoseiulus barkeri transcriptome. Recombinant venom NbSP2 peptide injected into Tetranychus cinnabarinus mites was significantly more lethal than recombinant NBSP1. NbSP2 was also lethal to Spodoptera litura when injected but not when fed to third instar larvae. The interaction proteins of NbSP2 in T. cinnabarinus and S. litura were identified by affinity chromatography. Among these proteins, ATP synthase subunit β (ATP SSβ) was deduced as a potential target. Four binding sites were predicted between NBSP2 and ATP SSβ of T. cinnabarinus and S. litura. In conclusion, we identified a venom peptide with activity against T. cinnabarinus and S. litura. This study provides a novel component for development of a new biological pesticide.Copyright © 2023. Published by Elsevier Inc.

MECHANICAL TRANSMISSIONS

Science (impact factor: 56.9) 1 ☒ TOP

S Spectrally engineered textile for radiative cooling against urban heat islands.

Wu, Sui, Chen, et. al

Abstract

Radiative cooling textiles hold promise for achieving personal thermal comfort under increasing global temperature. However, urban areas have heat island effects that largely diminish the effectiveness of cooling textiles as wearable fabrics because they

absorb emitted radiation from the ground and nearby buildings. We developed a mid-infrared spectrally selective hierarchical fabric (SSHF) with emissivity greatly dominant in the atmospheric transmission window through molecular design, minimizing the net heat gain from the surroundings. The SSHF features a high solar spectrum reflectivity of 0.97 owing to strong Mie scattering from the nano-micro hybrid fibrous structure. The SSHF is 2.3°C cooler than a solar-reflecting broadband emitter when placed vertically in simulated outdoor urban scenarios during the day and also has excellent wearable properties.

Nat Commun (impact factor: 16.6) 1 ☒

Nanoscale optical nonreciprocity with nonlinear metasurfaces

Aditya Tripathi, Chibuzor Fabian Ugwu, et. al

Abstract

Optical nonreciprocity is manifested as a difference in the transmission of light for the opposite directions of excitation. Nonreciprocal optics is traditionally realized with relatively bulky components such as optical isolators based on the Faraday rotation, hindering the miniaturization and integration of optical systems. Here we demonstrate free-space nonreciprocal transmission through a metasurface comprised of a two-dimensional array of nanoresonators made of silicon hybridized with vanadium dioxide (VO2). This effect arises from the magneto-electric coupling between Mie modes supported by the resonator. Nonreciprocal response of the nanoresonators occurs without the need for external bias; instead, reciprocity is broken by the incident light triggering the VO2 phase transition for only one direction of incidence. Nonreciprocal transmission is broadband covering over 100 nm in the telecommunication range in the vicinity of λ = 1.5 μm. Each nanoresonator unit cell occupies only ~0.1 λ3 in volume, with the metasurface thickness measuring about half-a-micron. Our self-biased nanoresonators exhibit nonreciprocity down to very low levels of intensity on the order of 150 W/cm2 or a μW per nanoresonator. We estimate picosecond-scale transmission fall times and sub-microsecond scale transmission rise. Our demonstration brings low-power, broadband and bias-free optical nonreciprocity to the nanoscale.

Sci Adv (impact factor: 13.6) 1 ☒

Programmable nonreciprocal Poynting effect enabled by lattice metamaterials.

Dong, Zhou, et. al

Abstract

Shear nonreciprocity, implying unequal shear forces in opposite shear directions, can be achieved by arranging structures asymmetrically. However, the nonreciprocal Poynting effect, i.e., unequal normal stresses induced by the same shear displacements

to the left and right, has not been fully explored. We discover the nonreciprocal Poynting effect using a generalized directional truss model. Inspired by this discovery, the cylindrical lattice metamaterials constructed from antisymmetric curled microstructures are used as a case study to generate the nonreciprocal Poynting effect. We develop a design framework that integrates digital generation, finite deformation theory, finite element modeling, and three-dimensional printing to program the nonreciprocal Poynting effect. Applications such as bionic Poynting effect matching, wave energy converter, and unidirectional motion limitation are demonstrated. This framework allows the one-to-one mapping between the torque and normal forces, paving the way for designing soft devices with precise force transmission capabilities.

OPTOELECTRONICS

Angew Chem Int Ed Engl (impact factor: 16.6) 1 区 TOP

A Unique Wide-Spacing Fence-Type Superstructure for Robust High-Voltage O3-Type Sodium Layered Cathode.

Mao, Zhang, et. al

Abstract

Enhancing the energy density of layered oxide cathode materials is of great significance for realizing high-performance sodium-ion batteries and promoting their commercial application. Lattice oxygen redox at high voltage usually enables a high capacity and energy density. But the structural degradation, severe voltage decay, and the resultant poor cycling performance caused by irreversible oxygen release seriously restrict the practical application. Herein we introduce a novel fence-type superstructure (2a × 3a type supercell) into O3-type layered cathode material Na0.9Li0.1Ni0.3Mn0.3Ti0.3O2 and achieve a stable cycling performance at a high voltage of 4.4 V. The fence-type superstructure effectively inhibits the formation of the vacancy clusters resulting from out-of-plane Li migration and in-plane transition metal migration at high voltage due to the wide d-spacing, thereby significantly reducing the irreversible release of lattice oxygen and greatly stabilizing the crystal structure. The cathode exhibits a high energy density of 545 Wh kg-1, a high rate capability (112.8 mAh g-1 at 5C) and a high cycling stability (85.8%@200 cycles with a high initial capacity of 148.6 mAh g-1 at 1C) accompanied by negligible voltage attenuation (98.5%@200 cycles). This strategy provides a distinct spacing effect of superstructure to design stable high-voltage layered cathode materials for Na-ion batteries.

J Am Chem Soc (impact factor: 15) 1 区 TOP

Bipolar Photoelectrochemistry for Phase-Modulated Optoelectronic Hybrid Nanomotor.

Cao, Huang, et. al

Abstract:
Complex micro/nanorobots may be constructed by integrating several independent, controlled nanomotors for high degrees of freedom of maneuvering and manipulation. However, designing nanomotors with distinctive responses to the same global stimuli is challenging due to the nanomotors' simple structure and limited material composition. In this work, we demonstrate that a nanomotor can be designed with the same principles of electronic circuits, where the motion of semiconductor particles can be controlled with synchronized electric and optical signals. This technique relies on transient bipolar photoelectrochemistry in semiconductor microparticles, where the reaction site selectivity is realized by modulating the light pulse in the time domain. Due to the microparticles' intrinsic resistance and surface capacitance, the nanomotors can be designed as an electronic circuit, enabling distinctive responses to the global electric/optical field and achieving the desired movement or deflection/rotation. This work gives new insight into the manipulation technique for independent and untethered nanomotor control. Ultimately, it exploits the potential for particle sorting based on geometry in time and frequency domain modulation.

J Colloid Interface Sci (impact factor: 9.9) 1 ☒

Multi-scale microstructural construction in ultralight graphene aerogels enables super elasticity and unprecedented durability for impact protection materials.

Hu, Tang, Tan, et. al

Abstract:
Ultralight graphene aerogels have gained extensive recognition in the impact protection field. However, attaining both elasticity and durability at low material density is challenging due to their intrinsic conflicts. Inspired by the mantis ootheca, we present a simultaneous improvement in the elasticity, durability, and density restrictions of ultralight graphene aerogels via constructing a multiscale honeycomb microstructure (MHM) within the graphene skeleton. This approach enables resulting graphene aerogel to achieve a strength per unit volume of 284.6 cm3 mg-1, the ability to recover its shape within 10 ms after an impact at 3.569 m/s, and maintain 97.2 % of its sample height after 20,000 cycles at 90 % strain. The operand analyses and calculation results reveal that the MHM structure facilitates this aerogel's dual-stage stress transfer pathway. Initially, the macroscale honeycomb structure (millimeter-scale) of the graphene aerogels bear and transmit stress to the surrounding regions, followed by the microscale honeycomb structure (micron-scale) deformation to convert stress kinetic energy into elastic potential energy. This two-stage stress transition mechanism of the MHM

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structure can effectively mitigate excessive local stress and suppress strain localization, thus providing remarkable elasticity and durability. Ultimately, the obtained graphene aerogel demonstrates promising applications as a fall height detection device and impact protective material.

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Ⅱ Concentration

PHYSICS

Localized thermal emission from topological interfaces

M. Said Ergoktas, Ali Kecebas, et al.

Abstract

The control of thermal radiation by shaping its spatial and spectral emission characteristics plays a key role in many areas of science and engineering. Conventional approaches to tailoring thermal emission using metamaterials are hampered both by the limited spatial resolution of the required subwavelength material structures and by the materials' strong absorption in the infrared. In this work, we demonstrate an approach based on the concept of topology. By changing a single parameter of a multilayer coating, we were able to control the reflection topology of a surface, with the critical point of zero reflection being topologically protected. The boundaries between subcritical and supercritical spatial domains host topological interface states with near-unity thermal emissivity. These topological concepts enable unconventional manipulation of thermal light for applications in thermal management and thermal camouflage.

Wavefunction matching for solving quantum many-body problems

Elhatisari, Serdar, et al.

Abstract

Ab initio calculations have an essential role in our fundamental understanding of quantum many-body systems across many subfields, from strongly correlated fermions[1,2,3] to quantum chemistry[4,5,6] and from atomic and molecular systems[7,8,9] to nuclear physics[10,11,12,13,14]. One of the primary challenges is to perform accurate calculations for systems where the interactions may be complicated and difficult for the chosen computational method to handle. Here we address the problem by introducing an approach called wavefunction matching. Wavefunction matching transforms the interaction between particles so that the wavefunctions up to some finite range match that of an easily computable interaction. This allows for calculations of systems that would otherwise be impossible owing to problems such as Monte Carlo sign cancellations. We apply the method to lattice Monte Carlo simulations[15,16] of light nuclei, medium-mass nuclei, neutron matter and nuclear matter. We use high-fidelity chiral effective field theory interactions[17,18] and find good agreement with empirical

data. These results are accompanied by insights on the nuclear interactions that may help to resolve long-standing challenges in accurately reproducing nuclear binding energies, charge radii and nuclear-matter saturation in ab initio calculations[19,20].

Superconducting diode effect and interference patterns in kagome CsV3Sb5

Le, Tian, Pan, et al.

Abstract

The interplay among frustrated lattice geometry, non-trivial band topology and correlation yields rich quantum states of matter in kagome systems[1,2]. A series of recent members in this family, AV_3Sb_5 (A = K, Rb or Cs), exhibit a cascade of symmetry-breaking transitions[3], involving the 3Q chiral charge ordering[4,5,6,7,8], electronic nematicity[9,10], roton pair density wave[11] and superconductivity[12]. The nature of the superconducting order is yet to be resolved. Here we report an indication of dynamic superconducting domains with boundary supercurrents in intrinsic CsV_3Sb_5 flakes. The magnetic field-free superconducting diode effect is observed with polarity modulated by thermal histories, suggesting that there are dynamic superconducting order domains in a spontaneous time-reversal symmetry-breaking background. Strikingly, the critical current exhibits double-slit superconductivity interference patterns when subjected to an external magnetic field. The characteristics of the patterns are modulated by thermal cycling. These phenomena are proposed as a consequence of periodically modulated supercurrents flowing along certain domain boundaries constrained by fluxoid quantization. Our results imply a time-reversal symmetry-breaking superconducting order, opening a potential for exploring exotic physics, for example, Majorana zero modes, in this intriguing topological kagome system.

MATERIALS

WS2 ribbon arrays with defined chirality and coherent polarity

Guodong Xue, Ziqi Zhou, et al.

Abstract

One-dimensional transition metal dichalcogenides exhibiting an enhanced bulk photovoltaic effect have the potential to exceed the Shockley–Queisser limit efficiency in solar energy harvest within p-n junction architectures. However, the collective output of these prototype devices remains a challenge. We report on the synthesis of single-crystalline WS2 ribbon arrays with defined chirality and coherent polarity through an

atomic manufacturing strategy. The chirality of WS2 ribbon was defined by substrate couplings into tunable armchair, zigzag, and chiral species, and the polarity direction was determined by the ribbon-precursor interfacial energy along a coherent direction. A single armchair ribbon showed strong bulk photovoltaic effect and the further integration of ~1000 aligned ribbons with coherent polarity enabled upscaling of the photocurrent.

Strong-bonding hole-transport layers reduce ultraviolet degradation of perovskite solar cells

Chengbin Fei, Anastasia Kuvayskaya, et al.

Abstract

The light-emitting diodes (LEDs) used in indoor testing of perovskite solar cells do not expose them to the levels of ultraviolet (UV) radiation that they would receive in actual outdoor use. We report degradation mechanisms of p-i-n–structured perovskite solar cells under unfiltered sunlight and with LEDs. Weak chemical bonding between perovskites and polymer hole-transporting materials (HTMs) and transparent conducting oxides (TCOs) dominate the accelerated A-site cation migration, rather than direct degradation of HTMs. An aromatic phosphonic acid, [2-(9-ethyl-9H-carbazol-3-yl)ethyl]phosphonic acid (EtCz3EPA), enhanced bonding at the perovskite/HTM/TCO region with a phosphonic acid group bonded to TCOs and a nitrogen group interacting with lead in perovskites. A hybrid HTM of EtCz3EPA with strong hole-extraction polymers retained high efficiency and improved the UV stability of perovskite devices, and a champion perovskite minimodule—independently measured by the Perovskite PV Accelerator for Commercializing Technologies (PACT) center—retained operational efficiency of >16% after 29 weeks of outdoor testing.

Metals strengthen with increasing temperature at extreme strain rates

Dowding, Ian, et al.

Abstract

The strength of materials depends on the rate at which they are tested, as defects, for example dislocations, that move in response to applied strains have intrinsic kinetic limitations[1,2,3,4]. As the deformation strain rate increases, more strengthening mechanisms become active and increase the strength[4,5,6,7]. However, the regime in which this transition happens has been difficult to access with traditional micromechanical strength measurements. Here, with microballistic impact testing at strain rates greater than 10^6 s^{-1}, and without shock conflation, we show that the strength of copper increases by about 30% for a 157 °C increase in temperature, an effect also observed in pure titanium and gold. This effect is counterintuitive, as almost all

materials soften when heated under normal conditions. This anomalous thermal strengthening across several pure metals is the result of a change in the controlling deformation mechanism from thermally activated strengthening to ballistic transport of dislocations, which experience drag through phonon interactions[1,8,9,10]. These results point to a pathway to better model and predict materials properties under various extreme strain rate conditions, from high-speed manufacturing operations[11] to hypersonic transport[12].

CHEMISTRY

Quantum interference in atom-exchange reactions

Yi-Xiang Liu, Lingbang Zhu, et. al

Abstract

Chemical reactions, in which bonds break and form, are highly dynamic quantum processes. A fundamental question is whether coherence can be preserved in chemical reactions and then harnessed to generate entangled products. Here we investigated this question by studying the 2KRb →K2 + Rb2 reaction at 500 nanokelvins, focusing on the nuclear spin degrees of freedom. We prepared the initial nuclear spins in KRb (potassium-rubidium) in an entangled state by lowering the magnetic field to where the spin-spin interaction dominates and characterized the preserved coherence in nuclear spin wave function after the reaction. We observed an interference pattern that is consistent with full coherence at the end of the reaction, suggesting that entanglement prepared within the reactants could be redistributed through the atom-exchange process.

Abundant hydrocarbons in the disk around a very-low-mass star

A. M. Arabhavi, I. Kamp, Th. Henning, et. al

Abstract

Very-low-mass stars (those less than 0.3 solar masses) host orbiting terrestrial planets more frequently than other types of stars. The compositions of those planets are largely unknown but are expected to relate to the protoplanetary disk in which they form. We used James Webb Space Telescope mid-infrared spectroscopy to investigate the chemical composition of the planet-forming disk around ISO-ChaI 147, a 0.11-solar-mass star. The inner disk has a carbon-rich chemistry; we identified emission from 13 carbon-bearing molecules, including ethane and benzene. The high column densities of hydrocarbons indicate that the observations probe deep into the disk. The high carbon-to-oxygen ratio indicates radial transport of material within the disk, which we predict

would affect the bulk composition of any planets forming in the disk.

Label-free detection and profiling of individual solution-phase molecules

Needham, Lisa-Maria, et. al

Abstract

Most chemistry and biology occurs in solution, in which conformational dynamics and complexation underlie behaviour and function. Single-molecule techniques[1] are uniquely suited to resolving molecular diversity and new label-free approaches are reshaping the power of single-molecule measurements. A label-free single-molecule method[2,3,4,5,6,7,8,9,10,11,12,13,14,15,16] capable of revealing details of molecular conformation in solution[17,18] would allow a new microscopic perspective of unprecedented detail. Here we use the enhanced light–molecule interactions in high-finesse fibre-based Fabry–Pérot microcavities[19,20,21] to detect individual biomolecules as small as 1.2 kDa, a ten-amino-acid peptide, with signal-to-noise ratios (SNRs) >100, even as the molecules are unlabelled and freely diffusing in solution. Our method delivers 2D intensity and temporal profiles, enabling the distinction of subpopulations in mixed samples. Notably, we observe a linear relationship between passage time and molecular radius, unlocking the potential to gather crucial information about diffusion and solution-phase conformation. Furthermore, mixtures of biomolecule isomers of the same molecular weight and composition but different conformation can also be resolved. Detection is based on the creation of a new molecular velocity filter window and a dynamic thermal priming mechanism that make use of the interplay between optical and thermal dynamics[22,23] and Pound–Drever–Hall (PDH) cavity locking[24] to reveal molecular motion even while suppressing environmental noise. New in vitro ways of revealing molecular conformation, diversity and dynamics can find broad potential for applications in the life and chemical sciences.

BIOLOGY

Cellular architecture shapes the naïve T cell response

Benjamin D. Hale, Yannik Severin, et al.

Abstract

After antigen stimulation, naïve T cells display reproducible population-level responses, which arise from individual T cells pursuing specific differentiation trajectories.

However, cell-intrinsic predeterminants controlling these single-cell decisions remain enigmatic. We found that the subcellular architectures of naïve CD8 T cells, defined by the presence (TØ) or absence (TO) of nuclear envelope invaginations, changed with maturation, activation, and differentiation. Upon T cell receptor (TCR) stimulation, naïve TØ cells displayed increased expression of the early-response gene Nr4a1, dependent upon heightened calcium entry. Subsequently, in vitro differentiation revealed that TØ cells generated effector-like cells more so compared with TO cells, which proliferated less and preferentially adopted a memory-precursor phenotype. These data suggest that cellular architecture may be a predeterminant of naïve CD8 T cell fate.

Defining the KRAS- and ERK-dependent transcriptome in KRAS-mutant cancers

Jeffrey A. Klomp, Jennifer E. Klomp, et. al

Abstract

How the KRAS oncogene drives cancer growth remains poorly understood. Therefore, we established a systemwide portrait of KRAS- and extracellular signal–regulated kinase (ERK)–dependent gene transcription in KRAS-mutant cancer to delineate the molecular mechanisms of growth and of inhibitor resistance. Unexpectedly, our KRAS-dependent gene signature diverges substantially from the frequently cited Hallmark KRAS signaling gene signature, is driven predominantly through the ERK mitogen-activated protein kinase (MAPK) cascade, and accurately reflects KRAS- and ERK-regulated gene transcription in KRAS-mutant cancer patients. Integration with our ERK-regulated phospho- and total proteome highlights ERK deregulation of the anaphase promoting complex/cyclosome (APC/C) and other components of the cell cycle machinery as key processes that drive pancreatic ductal adenocarcinoma (PDAC) growth. Our findings elucidate mechanistically the critical role of ERK in driving KRAS-mutant tumor growth and in resistance to KRAS-ERK MAPK targeted therapies.

A master regulator of opioid reward in the ventral prefrontal cortex

Alexander C. W. Smith, Soham Ghoshal, et. al

Abstract

In addition to their intrinsic rewarding properties, opioids can also evoke aversive reactions that protect against misuse. Cellular mechanisms that govern the interplay between opioid reward and aversion are poorly understood. We used whole-brain activity mapping in mice to show that neurons in the dorsal peduncular nucleus (DPn)

are highly responsive to the opioid oxycodone. Connectomic profiling revealed that DPn neurons innervate the parabrachial nucleus (PBn). Spatial and single-nuclei transcriptomics resolved a population of PBn-projecting pyramidal neurons in the DPn that express μ-opioid receptors (μORs). Disrupting μOR signaling in the DPn switched oxycodone from rewarding to aversive and exacerbated the severity of opioid withdrawal. These findings identify the DPn as a key substrate for the abuse liability of opioids.

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Ⅲ Calling for papers

ICDME 2024(EI)

Submission deadline: **Jun 25, 2024**
Conference date: **Nov 24, 2024 - Nov 26, 2024**
Full name: **8th International Conference on Design and Manufacturing Engineering**
Location: **Barcelona, Spain**
Website: http://www.icdme.org

Welcome to the official website of 2024 the 8th International Conference on Design and Manufacturing Engineering (ICDME 2024). ICDME 2024 will take place on November 24-26, 2024 in Barcelona, Spain, as workshop of MAES 2024.
The aim as well as objective of ICDME 2024 is to present the latest research and results of scientists related to Design and Manufacturing Engineering topics. This conference provides opportunities for the delegates to exchange new ideas face-to-face, to establish business or research relations as well as to find global partners for future collaborations. We hope that the conference results will lead to significant contributions to the knowledge in these up-to-date scientific fields.

Call for papers:
Concurrent engineering, agile manufacturing, rapid prototyping
Material science and engineering materials
Manufacturing technologies, production, control
Mechanical transmissions
Engineering management
Sustainable development, lifecycle assessment, Eco-design, Eco-manufacture and renewable energy
Web/Internet technologies
Experimental and theoretical analyses, finite/boundary element methods, optimisation
Soft computing, artificial intelligence, evolutionary computing, agent computing
Computer simulation, multimedia, virtual reality
More topics: http://www.icdme.org/cfp.html

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ICMEE 2024(IEEE)

Submission deadline:	**Jun 30, 2024**
Conference date:	**Nov 15, 2024 - Nov 17, 2024**
Full name:	**10th International Conference on Mechanical and Electronics Engineering and Mobile Computing**
Location:	**Xi'an, China**
Website:	http://www.icmee.org

Mechanical and Electronics Engineering is an interdisciplinary field that combines mechanical engineering principles with electronics and computer technology to design, develop and manufacture advanced systems and products. This field encompasses a broad range of applications, including robotics and automation systems, power electronics and applications, control theory and applications, and intelligent systems. The increasing demand for high-performance and energy-efficient systems has led to rapid advancements in this field, such as the development of smart materials, sensor technologies, and micro/nano devices.

2024 the 10th International Conference on Mechanical and Electronics Engineering (ICMEE) is to be held in Xi'an, China on November 15-17, 2024, which will be Sponsored by BICRI and hosted by Xi'an University of Posts & Telecommunications, China. It aims to provide a platform for researchers, engineers, and practitioners to exchange ideas, present their latest research findings, and discuss the future directions of this exciting field. The conference will cover a wide range of topics, including but not limited to mechanical design, material engineering, mechatronics, robotics, automation systems, signal processing, and electronics instrumentation.

Topics of Interest :

- Acoustics and Noise Control Marine System Design
- Ballistics MEMS and Nano Technology
- CAD/CAM/CIM New and Renewable Energy
- CFD Noise and Vibration
- Composite and Smart Materials Noise Control
- HVAC Textile and Leather Technology
- Internal Combustion Engines Tribology
- Machinery and Machine Design Turbulence
- Electrical materials Electromagnetics
- High voltage techniques microwave
- Power electronics and applications antennas
- Mechatronics Communication theory and systems
- Control theory and applications Optoelectronics
- Robotics and automation systems Biomedical electronics
- Intelligent systems Sensors
- Electronics instrumentation

For more topics, please visit: http://icmee.org/cfp.html

CRET 2024(EI)

Submission deadline: **Jul 1, 2024**
Conference date: **Nov 14, 2024 - Nov 16, 2024**
Full name: **2024 International Conference on Control, Robotics Engineering and Technology**
Location: **Milan, Italy**
Website: http://www.cret.net/

2024 International Conference on Control, Robotics Engineering and Technology (CRET 2024) will be held in Milan, Italy during November 14th-16th, 2024, as the workshop of CompAuto 2024.
Control is an interdisciplinary branch of engineering and mathematics dealing with the design, identification and analysis to provide specific tasks system desired performance. Robotics is the science and engineering concerned with the design, manufacture and application of robots, and computer systems for their control, sensory feedback, and information processing. Nowadays, control engineering and robotics technology have permeated into every single part of our lives and will continue to play an important role in our societies.
The aim of CRET 2024 is to provide a platform to the researchers and practitioners from both academia as well as industry to meet and share cutting-edge development in the field of Control, Robotics Engineering and Technology. On behalf of organizing committee, we warmly invite you, Control, Robotics Engineering and Technology scientist, engineer or technician, graduate student, or simply interested by the technique, to take part in this unique and innovative conference with your enthusiasm to develop, your desire to apply and your willingness to mature the Control, Robotics Engineering and Technology technique and their applications.
We look forward to receiving your contributions and meeting you at CRET 2024!

Call for Papers:

★Control Science and Engineering
* Adaptive Control
* Adaptive Signal Processing and Control
* Biological Inspired Sensors
* Complex Systems
* Computer and Microprocessor-Bzcations
* Control Engineering Education
* Control of Biological Systems
* Co-Operative Control
* Discrete Event Systems

★Robotics Engineering and Technology
* Autonomous Agents
* Cognitive Approach for Robotics
* Collective and Social Robots
* Control and Supervision Systems
* Dexterous Manipulation
* Engineering Applications
* Human Centered Systems
* Human-Machine Interfaces
* Humanoid Robots

More details, please view: http://www.cret.net/cfp.html

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IRCE 2024(IEEE)

Submission deadline: **Jul 1, 2024**
Conference date: **Aug 7, 2024 - Aug 9, 2024**
Full name: **7th International Conference on Intelligent Robotics and Control Engineering**
Location: **Xi'an, China**
Website: http://www.irce.org

Intelligent Robotics and Control Engineering is a rapidly growing field that combines robotics, artificial intelligence, and control engineering. Over the years, the field has witnessed tremendous growth, fueled by the demand for advanced robotic systems that can perform complex tasks autonomously. Intelligent robotics has found numerous applications in industries such as manufacturing, healthcare, agriculture, and transportation. Control engineering, on the other hand, focuses on developing control systems that can regulate and maintain the behavior of complex systems. The integration of these two fields has led to the development of advanced robotic systems that can operate autonomously and adapt to their environment. The field has seen significant advancements in areas such as machine learning, computer vision, path planning, and decision-making algorithms, all of which have contributed to the development of more sophisticated and intelligent robotic systems.

It is our great pleasure to invite you to join The 7th International Conference on Intelligent Robotics and Control Engineering (IRCE 2024), which will be hosted in Xi'an, China during August 7-9, 2024. IRCE is co-sponsored by Xi'an University of Technology, China, IEEE and IEEE Robotics and Automation Society, hosted by School of Automation and Information Engineering, Xi'an University of Technology, China, patrons are Northeastern University, China, Concordia University, Canada, Northeast Electric Power University, China, Tianjin University, China and Northwest Minzu University, China etc.. This event will provide unique opportunity to have fruitful discussions about Intelligent Robotics, Automations and Control Engineering, and best practices that address Artificial Intelligence. The IRCE conference aims to foster interdisciplinary and international collaboration opportunities, and strengthen domestic and international recognition in pure and applied research for the participants.

***Call for papers:**

~ Intelligent Robotics
Robot design
Robot perception/vision
Soft robotics and liquid metal robots
~ Automations & Control Engineering
Data/Event driven modeling and control
Production planning, scheduling and control
Computational intelligence in automation
~ Artificial Intelligence
Computer vision and image reconstruction
Deep/Continual/Adversarial learning
AI architectures and applications agents
***More topics, please go to: http://www.irce.org/call-for-papers.html

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RCAE 2024

Submission deadline: **Jul 15, 2024**
Conference date: **Oct 25, 2024 - Oct 27, 2024**
Full name: **7th International Conference on Robotics, Control and Automation Engineering and Machine Learning**
Location: **Wuhu, China**
Website: http://www.rcae.net/

The International Conference on Robotics, Control and Automation Engineering (RCAE) provides a platform for presenting and discussing the latest advancements in these fields. Topics include robot perception, planning, and control, intelligent and autonomous systems, control and optimization techniques, and machine learning methods for robotics. The conference aims to promote the development of new technologies and methods that can enhance the performance, efficiency, and safety of robotic systems in various applications.
The 7th International Conference on Robotics, Control and Automation Engineering (RCAE 2024) will take place in Wuhu, China during October 25-27, 2024. It's co-sponsored by Anhui Polytechnic University, IEEE, and IEEE RAS. Researchers, engineers, practitioners, and students from industry, universities, and government agencies are invited to present their latest work and discuss research and applications for robotics, control, and automation engineering cooperation. Technical sessions, poster sessions, and technical visits will be organized.

Topics of interest

A. Robotics and Control
Mobile robots
Humanoid robots
Micro robots and micro-manipulation
Search, rescue and field robotics
Space and underwater robots
Medical robots and bio-robotics
B. Autonomous Systems
Intelligent autonomous systems
Cognitive approach for robotics
Networked control systems
Machine learning
Multi-agent systems
C. Perception and Sensing
Perception systems
Robot sensing and data fusion
Localization, navigation and mapping
Sensor networks
Neural networks
D. Control Systems
Adaptive control
Control system modeling
Robust control
Optimal control
Discrete event systems
E. Automation and Computing
Process automation
Intelligent automation
Home, laboratory and service automation
Building energy efficiency
Cloud computing
More Topics, please visit http://www.rcae.net/cfp.html

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