

图书情报专题研究

最新学科研究热点与前沿
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前 言

《图书情报专题研究》的宗旨是为我校师生开展学术研究提供有价值的参考信息，此项工作由图书馆信息咨询服务部承担。“最新学科研究热点与前沿”根据学校所购买的数字资源，通过分析其深层次的功能，从数据库中组织整理出了与我校学科领域相关的最新学科热点研究论文、最新研究前沿及最新国际会议信息等，以期能对我校师生开展学术研究、项目立项、开题等学术研究活动提供帮助。

本期收集整理了如下七个方面的热点文献和前沿信息：

1、Nature Latest Research, Nature Physics 最新研究进展；

2、IEL Top25, IEL 数据库下载最多的 25 篇论文；

3、ESI (Essential Science Indicators) HOT PAPERS, 按照 ESI 某一学科热点论文被引频次排名选取前 25 篇；

4、ESI (Essential Science Indicators) HIGHLY CITED PAPERS, 按照 ESI 某一学科高被引论文被引频次排名选取前 25 篇；

5、AIAA、IAF 最新会议，由 AIAA、IAF 主站提供的最新会议信息，可供相关研究者参考；

6、ACM 最新会议，根据 ACM 主页所提供的最新会议信息整理所得，可供相关研究者参考；

7、IQPC 最新会议，由国际质量与竞争力中心 (IQPC: International Quality and Productivity Center) 提供的最新国际会议，内容涉及国防、能源、工业、科技、电信等领域。IQPC 是国际顶级的会议展览策划公司，于 1973 年成立于美国，旨在为全球业务主管提供量身定制的会议、大型会展以及培训课程，积极为行业人士的相互交流创建平台，使业内人士能够随时掌握行业发展的最新趋势及技术创新。

如果您对我们的栏目设置、内容编排等有好的意见和建议，欢迎与我们联系 (电话：88492928)，我们将积极采纳，使这份电子刊物日臻完善，共同为把我校建成学科特色鲜明的世界一流大学而努力。

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NatureLatest Research(Physics)

来源: <https://www.nature.com/physics/>

1. 标题: Quantum anomalous Hall effect from intertwined moiré bands

作者: Tingxin Li, Shengwei Jiang, Bowen Shen, Yang Zhang, Lizhong Li, Zui Tao, Trithip Devakul, Kenji Watanabe, Takashi Taniguchi, Liang Fu, Jie Shan & Kin Fai Mak

摘要: Electron correlation and topology are two central threads of modern condensed matter physics. Semiconductor moiré materials provide a highly tuneable platform for studies of electron correlation. Correlation-driven phenomena, including the Mott insulator, generalized Wigner crystals, stripe phases and continuous Mott transition, have been demonstrated. However, non-trivial band topology has remained unclear. Here we report the observation of a quantum anomalous Hall effect in AB-stacked MoTe₂/WSe₂ moiré heterobilayers. Unlike in the AA-stacked heterobilayers, an out-of-plane electric field not only controls the bandwidth but also the band topology by intertwining moiré bands centred at different layers. At half band filling, corresponding to one particle per moiré unit cell, we observe quantized Hall resistance, h/e^2 (with h and e denoting the Planck's constant and electron charge, respectively), and vanishing longitudinal resistance at zero magnetic field. The electric-field-induced topological phase transition from a Mott insulator to a quantum anomalous Hall insulator precedes an insulator-to-metal transition. Contrary to most known topological phase transitions, it is not accompanied by a bulk charge gap closure. Our study paves the way for discovery of emergent phenomena arising from the combined influence of strong correlation and topology in semiconductor moiré materials.

链接: <https://www.nature.com/articles/s41586-021-04171-1>

2. 标题: Programmable interactions and emergent geometry in an array of atom clouds

作者: Avikar Periwal, Eric S. Cooper, Philipp Kunkel, Julian F. Wienand, Emily J. Davis & Monika Schleier-Smith

摘要: Interactions govern the flow of information and the formation of correlations between constituents of many-body quantum systems, dictating phases of matter found in nature and forms of entanglement generated in the laboratory. Typical interactions decay with distance and thus produce a network of connectivity governed by geometry—such as the crystalline structure of a material or the trapping sites of atoms in a quantum simulator. However, many envisioned applications in quantum simulation and computation require more complex coupling graphs including non-local interactions, which feature in models of information scrambling in black holes and mappings of hard optimization problems onto frustrated classical magnets. Here we describe the realization of programmable non-local interactions in an array of atomic ensembles within an optical cavity, in which photons carry information between atomic spins. By programming the distance dependence of the interactions, we access effective geometries for which the dimensionality, topology and metric are entirely distinct from the physical geometry of the array.

As examples, we engineer an antiferromagnetic triangular ladder, a Möbius strip with sign-changing interactions and a treelike geometry inspired by concepts of quantum gravity. The tree graph constitutes a toy model of holographic duality, in which the quantum system lies on the boundary of a higher-dimensional geometry that emerges from measured correlations. Our work provides broader prospects for simulating frustrated magnets and topological phases, investigating quantum optimization paradigms and engineering entangled resource states for sensing and computation.

链接: <https://www.nature.com/articles/s41586-021-04156-0>

3. 标题: Single-year radiocarbon dating anchors Viking Age trade cycles in time

作者: Bente Philippsen, Claus Feveile, Jesper Olsen & Søren M. Sindbæk

摘要: Recent discoveries of rapid changes in the atmospheric ^{14}C concentration linked to solar particle events have spurred the construction of new radiocarbon annual calibration datasets. With these datasets, radiocarbon dating becomes relevant for urban sites, which require dates at higher resolution than previous calibration datasets could offer. Here we use a single-year radiocarbon calibration curve to anchor the archaeological stratigraphy of a Viking Age trade centre in time. We present absolutely dated evidence for artefact finds charting the expansion of long-distance trade from as far away as Arctic Norway and the Middle East, which we linked to the beginning of the Viking Age at $\text{AD } 790 \pm 10$. The methods developed here enable human interactions and cultural, climatic and environmental changes to be compared in archaeological stratigraphies worldwide.

链接: <https://www.nature.com/articles/s41586-021-04240-5>

4. 标题: Integrated photonics enables continuous-beam electron phase modulation

作者: Jan-Wilke Henke, Arslan Sajid Raja, Armin Feist, Guan hao Huang, Germaine Arend, Yujia Yang, F. Jasmin Kappert, Rui Ning Wang, Marcel Möller, Jiahe Pan, Junqiu Liu, Ofer Kfir, Claus Ropers & Tobias J. Kippenberg

摘要: Integrated photonics facilitates extensive control over fundamental light-matter interactions in manifold quantum systems including atoms, trapped ions, quantum dots and defect centres. Ultrafast electron microscopy has recently made free-electron beams the subject of laser-based quantum manipulation and characterization, enabling the observation of free-electron quantum walks, attosecond electron pulses and holographic electromagnetic imaging. Chip-based photonics promises unique applications in nanoscale quantum control and sensing but remains to be realized in electron microscopy. Here we merge integrated photonics with electron microscopy, demonstrating coherent phase modulation of a continuous electron beam using a silicon nitride microresonator. The high-finesse ($Q_0 \approx 106$) cavity enhancement and a waveguide designed for phase matching lead to efficient electron-light scattering at extremely low, continuous-wave optical powers. Specifically, we fully deplete the initial electron state at a cavity-coupled power of only 5.35 microwatts and generate >500 electron energy sidebands for several milliwatts. Moreover, we probe unidirectional intracavity fields with microelectronvolt resolution in electron-energy-gain spectroscopy. The fibre-coupled photonic structures feature single-optical-mode electron-light interaction with full control over the input and output light. This approach establishes a versatile and highly efficient framework for enhanced electron beam



control in the context of laser phase plates, beam modulators and continuous-wave attosecond pulse trains, resonantly enhanced spectroscopy and dielectric laser acceleration. Our work introduces a universal platform for exploring free-electron quantum optics, with potential future developments in strong coupling, local quantum probing and electron–photon entanglement.

链接: <https://www.nature.com/articles/s41586-021-04197-5>

5. 标题: High-entropy polymer produces a giant electrocaloric effect at low fields

作者: Xiaoshi Qian, Donglin Han, Lirong Zheng, Jie Chen, Madhusudan Tyagi, Qiang Li, Feihong Du, Shanyu Zheng, Xingyi Huang, Shihai Zhang, Junye Shi, Houbing Huang, Xiaoming Shi, Jiangping Chen, Hancheng Qin, Jerzy Bernholc, Xin Chen, Long-Qing Chen, Liang Hong & Q. M. Zhang

摘要: More than a decade of research on the electrocaloric (EC) effect has resulted in EC materials and EC multilayer chips that satisfy a minimum EC temperature change of 5 K required for caloric heat pumps. However, these EC temperature changes are generated through the application of high electric fields (close to their dielectric breakdown strengths), which result in rapid degradation and fatigue of EC performance. Here we report a class of EC polymer that exhibits an EC entropy change of $37.5 \text{ J kg}^{-1} \text{ K}^{-1}$ and a temperature change of 7.5 K under 50 MV m^{-1} , a 275% enhancement over the state-of-the-art EC polymers under the same field strength. We show that converting a small number of the chlorofluoroethylene groups in poly(vinylidene fluoride-trifluoroethylene-chlorofluoroethylene) terpolymer into covalent double bonds markedly increases the number of the polar entities and enhances the polar–nonpolar interfacial areas of the polymer. The polar phases in the polymer adopt a loosely correlated, high-entropy state with a low energy barrier for electric-field-induced switching. The polymer maintains performance for more than one million cycles at the low fields necessary for practical EC cooling applications, suggesting that this strategy may yield materials suitable for use in caloric heat pumps.

链接: <https://www.nature.com/articles/s41586-021-04189-5>

6. 标题: Resonance from antiferromagnetic spin fluctuations for superconductivity in UTe₂

作者: Chunruo Duan, R. E. Baumbach, Andrey Podlesnyak, Yuhang Deng, Camilla Moir, Alexander J. Breindel, M. Brian Maple, E. M. Nica, Qimiao Si & Pengcheng Dai

摘要: Superconductivity originates from the formation of bound (Cooper) pairs of electrons that can move through the lattice without resistance below the superconducting transition temperature T_c . Electron Cooper pairs in most superconductors form anti-parallel spin singlets with total spin $S = 0$, although they can also form parallel spin-triplet Cooper pairs with $S = 1$ and an odd parity wavefunction³. Spin-triplet pairing is important because it can host topological states and Majorana fermions relevant for quantum computation^{4,5}. Because spin-triplet pairing is usually mediated by ferromagnetic (FM) spin fluctuations³, uranium-based materials near an FM instability are considered to be ideal candidates for realizing spin-triplet superconductivity⁶. Indeed, UTe₂, which has a $T_c \approx 1.6 \text{ K}$ has been identified as a candidate for a chiral spin-triplet topological superconductor near an FM instability, although it also has antiferromagnetic (AF) spin fluctuations. Here we use inelastic neutron scattering (INS) to show that superconductivity in UTe₂ is coupled to a sharp magnetic excitation, termed resonance³, at the Brillouin zone boundary



near AF order. Because the resonance has only been found in spin-singlet unconventional superconductors near an AF instability, its observation in UTe₂ suggests that AF spin fluctuations may also induce spin-triplet pairing²⁴ or that electron pairing in UTe₂ has a spin-singlet component.

链接: <https://www.nature.com/articles/s41586-021-04151-5>

7. 标题: Spin splitting of dopant edge state in magnetic zigzag graphene nanoribbons

作者: Raymond E. Blackwell, Fangzhou Zhao, Erin Brooks, Junmian Zhu, Ilya Piskun, Shenkai Wang, Aidan Delgado, Yea-Lee Lee, Steven G. Louie & Felix R. Fischer

摘要: Spin-ordered electronic states in hydrogen-terminated zigzag nanographene give rise to magnetic quantum phenomena that have sparked renewed interest in carbon-based spintronics. Zigzag graphene nanoribbons (ZGNRs)—quasi one-dimensional semiconducting strips of graphene bounded by parallel zigzag edges—host intrinsic electronic edge states that are ferromagnetically ordered along the edges of the ribbon and antiferromagnetically coupled across its width. Despite recent advances in the bottom-up synthesis of GNRs featuring symmetry protected topological phases and even metallic zero mode bands, the unique magnetic edge structure of ZGNRs has long been obscured from direct observation by a strong hybridization of the zigzag edge states with the surface states of the underlying support. Here, we present a general technique to thermodynamically stabilize and electronically decouple the highly reactive spin-polarized edge states by introducing a superlattice of substitutional N-atom dopants along the edges of a ZGNR. First-principles GW calculations and scanning tunnelling spectroscopy reveal a giant spin splitting of low-lying nitrogen lone-pair flat bands by an exchange field (~850 tesla) induced by the ferromagnetically ordered edge states of ZGNRs. Our findings directly corroborate the nature of the predicted emergent magnetic order in ZGNRs and provide a robust platform for their exploration and functional integration into nanoscale sensing and logic devices.

链接: <https://www.nature.com/articles/s41586-021-04112-y>

8. 标题: Observation of Feshbach resonances between a single ion and ultracold atoms

作者: Pascal Weckesser, Fabian Thielemann, Dariusz Wiater, Agata Wojciechowska, Leon Karpa, Krzysztof Jachymski, Michał Tomza, Thomas Walker & Tobias Schaetz

摘要: The control of physical systems and their dynamics on the level of individual quanta underpins both fundamental science and quantum technologies. Trapped atomic and molecular systems, neutral¹ and charged², are at the forefront of quantum science. Their extraordinary level of control is evidenced by numerous applications in quantum information processing^{3,4} and quantum metrology^{5,6}. Studies of the long-range interactions between these systems when combined in a hybrid atom-ion trap have led to landmark results^{9,10,11,12,13,14,15,16,17,18,19}. However, reaching the ultracold regime—where quantum mechanics dominates the interaction, for example, giving access to controllable scattering resonances^{20,21}—has so far been elusive. Here we demonstrate Feshbach resonances between ions and atoms, using magnetically tunable interactions between ¹³⁸Ba⁺ ions and ⁶Li atoms. We tune the experimental parameters to probe different interaction processes—first, enhancing three-body reactions and the related losses to identify the resonances and then making two-body interactions dominant to investigate the ion's sympathetic cooling in the ultracold atomic bath. Our results provide deeper insights into

atom-ion interactions, giving access to complex many-body systems and applications in experimental quantum simulation.

链接: <https://www.nature.com/articles/s41560-021-00867-w>

9. 标题: Detecting spins by their fluorescence with a microwave photon counter

作者: Emanuele Albertinale, Léo Balembois, Eric Billaud, Vishal Ranjan, Daniel Flanigan, Thomas Schenkel, Daniel Estève, Denis Vion, Patrice Bertet & Emmanuel Flurin

摘要: Quantum emitters respond to resonant illumination by radiating part of the absorbed energy. A component of this radiation field is phase coherent with the driving tone, whereas another component is incoherent and consists of spontaneously emitted photons, forming the fluorescence signal. Atoms, molecules and colour centres are routinely detected by their fluorescence at optical frequencies, with important applications in quantum technology and microscopy. By contrast, electron spins are usually detected by the phase-coherent echoes that they emit in response to microwave driving pulses. The incoherent part of their radiation—a stream of microwave photons spontaneously emitted upon individual spin relaxation events—has not been observed so far because of the low spin radiative decay rate and of the lack of single microwave photon detectors (SMPDs). Here using superconducting quantum devices, we demonstrate the detection of a small ensemble of donor spins in silicon by their fluorescence at microwave frequencies and millikelvin temperatures. We enhance their radiative decay rate by coupling them to a high-quality-factor and small-mode-volume superconducting resonator, and we connect the device output to a newly developed SMPD based on a superconducting qubit. In addition, we show that the SMPD can be used to detect spin echoes and that standard spin characterization measurements (Rabi nutation and spectroscopy) can be achieved with both echo and fluorescence detection. We discuss the potential of SMPD detection as a method for magnetic resonance spectroscopy of small numbers of spins.

链接: <https://www.nature.com/articles/s41586-021-04076-z>

10. 标题: Direct limits for scalar field dark matter from a gravitational-wave detector

作者: Sander M. Vermeulen, Philip Relton, Hartmut Grote, Vivien Raymond, Christoph Affeldt, Fabio Bergamin, Aparna Bisht, Marc Brinkmann, Karsten Danzmann, Suresh Doravari, Volker Kringel, James Lough, Harald Lück, Moritz Mehmet, Nikhil Mukund, Séverin Nadji, Emil Schreiber, Borja Sorazu, Kenneth A. Strain, Henning Vahlbruch, Michael Weinert, Benno Willke & Holger Wittel

摘要: The nature of dark matter remains unknown to date, although several candidate particles are being considered in a dynamically changing research landscape. Scalar field dark matter is a prominent option that is being explored with precision instruments, such as atomic clocks and optical cavities. Here we describe a direct search for scalar field dark matter using a gravitational-wave detector, which operates beyond the quantum shot-noise limit. We set new upper limits on the coupling constants of scalar field dark matter as a function of its mass, by excluding the presence of signals that would be produced through the direct coupling of this dark matter to the beam splitter of the GEO600 interferometer. These constraints improve on bounds from previous direct searches by more than six orders of magnitude and are, in some cases, more stringent than limits obtained in tests of the equivalence principle by up to four orders of



magnitude. Our work demonstrates that scalar field dark matter can be investigated or constrained with direct searches using gravitational-wave detectors and highlights the potential of quantum-enhanced interferometry for dark matter detection.

链接: <https://www.nature.com/articles/s41586-021-04031-y>

11. 标题: Fractional Chern insulators in magic-angle twisted bilayer graphene

作者: Yonglong Xie, Andrew T. Pierce, Jeong Min Park, Daniel E. Parker, Eslam Khalaf, Patrick Ledwith, Yuan Cao, Seung Hwan Lee, Shaowen Chen, Patrick R. Forrester, Kenji Watanabe, Takashi Taniguchi, Ashvin Vishwanath, Pablo Jarillo-Herrero & Amir Yacoby

摘要: Fractional Chern insulators (FCIs) are lattice analogues of fractional quantum Hall states that may provide a new avenue towards manipulating non-Abelian excitations. Early theoretical studies have predicted their existence in systems with flat Chern bands and highlighted the critical role of a particular quantum geometry. However, FCI states have been observed only in Bernal-stacked bilayer graphene (BLG) aligned with hexagonal boron nitride (hBN)⁸, in which a very large magnetic field is responsible for the existence of the Chern bands, precluding the realization of FCIs at zero field. By contrast, magic-angle twisted BLG supports flat Chern bands at zero magnetic field, and therefore offers a promising route towards stabilizing zero-field FCIs. Here we report the observation of eight FCI states at low magnetic field in magic-angle twisted BLG enabled by high-resolution local compressibility measurements. The first of these states emerge at 5 T, and their appearance is accompanied by the simultaneous disappearance of nearby topologically trivial charge density wave states. We demonstrate that, unlike the case of the BLG/hBN platform, the principal role of the weak magnetic field is merely to redistribute the Berry curvature of the native Chern bands and thereby realize a quantum geometry favourable for the emergence of FCIs. Our findings strongly suggest that FCIs may be realized at zero magnetic field and pave the way for the exploration and manipulation of anyonic excitations in flat moiré Chern bands.

链接: <https://www.nature.com/articles/s41586-021-04002-3>

12. 标题: Quantum theory based on real numbers can be experimentally falsified

作者: Marc-Olivier Renou, David Trillo, Mirjam Weilenmann, Thinh P. Le, Armin Tavakoli, Nicolas Gisin, Antonio Acín & Miguel Navascués

摘要: Although complex numbers are essential in mathematics, they are not needed to describe physical experiments, as those are expressed in terms of probabilities, hence real numbers. Physics, however, aims to explain, rather than describe, experiments through theories. Although most theories of physics are based on real numbers, quantum theory was the first to be formulated in terms of operators acting on complex Hilbert spaces. This has puzzled countless physicists, including the fathers of the theory, for whom a real version of quantum theory, in terms of real operators, seemed much more natural. In fact, previous studies have shown that such a ‘real quantum theory’ can reproduce the outcomes of any multipartite experiment, as long as the parts share arbitrary real quantum states. Here we investigate whether complex numbers are actually needed in the quantum formalism. We show this to be case by proving that real and complex Hilbert-space formulations of quantum theory make different predictions in network scenarios comprising independent states and measurements. This allows us to devise a Bell-like experiment,

the successful realization of which would disprove real quantum theory, in the same way as standard Bell experiments disproved local physics.

链接: <https://www.nature.com/articles/s41586-021-04160-4>

13. 标题: Sublimation-driven convection in Sputnik Planitia on Pluto

作者: Adrien Morison, Stéphane Labrosse & Gaël Choblet

摘要: Sputnik Planitia is a nitrogen-ice-filled basin on Pluto. Its polygonal surface patterns have been previously explained as a result of solid-state convection with either an imposed heat flow or a temperature difference within the 10-km-thick ice layer. Neither explanation is satisfactory, because they do not exhibit surface topography with the observed pattern: flat polygons delimited by narrow troughs. Internal heating produces the observed patterns⁶, but the heating source in such a setup remains enigmatic. Here we report the results of modelling the effects of sublimation at the surface. We find that sublimation-driven convection readily produces the observed polygonal structures if we assume a smaller heat flux ($\sim 0.3 \text{ mW m}^{-2}$) at the base of the ice layer than the commonly accepted value of $2\text{--}3 \text{ mW m}^{-2}$ (ref. 7). Sustaining this regime with the latter value is also possible, but would require a stronger viscosity contrast ($\sim 3,000$) than the nominal value (~ 100) considered in this study.

链接: <https://www.nature.com/articles/s41586-021-04095-w>

14. 标题: Giant modulation of optical nonlinearity by Floquet engineering

作者: Jun-Yi Shan, M. Ye, H. Chu, Sungmin Lee, Je-Geun Park, L. Balents & D. Hsieh

摘要: Strong periodic driving with light offers the potential to coherently manipulate the properties of quantum materials on ultrafast timescales. Recently, strategies have emerged to drastically alter electronic and magnetic properties by optically inducing non-trivial band topologies, emergent spin interactions and even superconductivity. However, the prospects and methods of coherently engineering optical properties on demand are far less understood. Here we demonstrate coherent control and giant modulation of optical nonlinearity in a van der Waals layered magnetic insulator, manganese phosphorus trisulfide (MnPS₃). By driving far off-resonance from the lowest on-site manganese d-d transition, we observe a coherent on-off switching of its optical second harmonic generation efficiency on the timescale of 100 femtoseconds with no measurable dissipation. At driving electric fields of the order of 10⁹ volts per metre, the on-off ratio exceeds 10, which is limited only by the sample damage threshold. Floquet theory calculations¹⁴ based on a single-ion model of MnPS₃ are able to reproduce the measured driving field amplitude and polarization dependence of the effect. Our approach can be applied to a broad range of insulating materials and could lead to dynamically designed nonlinear optical elements.

链接: <https://www.nature.com/articles/s41586-021-04051-8>

15. 标题: Sound emission and annihilations in a programmable quantum vortex collider

作者: W. J. Kwon, G. Del Pace, K. Xhani, L. Galantucci, A. Muzi Falconi, M. Inguscio, F. Scazza & G. Roati

摘要: In quantum fluids, the quantization of circulation forbids the diffusion of a vortex swirling flow seen in classical viscous fluids. Yet, accelerating quantum vortices may lose their energy into



acoustic radiations, similar to the way electric charges decelerate on emitting photons. The dissipation of vortex energy underlies central problems in quantum hydrodynamics, such as the decay of quantum turbulence, highly relevant to systems as varied as neutron stars, superfluid helium and atomic condensates⁴. A deep understanding of the elementary mechanisms behind irreversible vortex dynamics has been a goal for decades, but it is complicated by the shortage of conclusive experimental signatures. Here we address this challenge by realizing a programmable vortex collider in a planar, homogeneous atomic Fermi superfluid with tunable inter-particle interactions. We create on-demand vortex configurations and monitor their evolution, taking advantage of the accessible time and length scales of ultracold Fermi gases. Engineering collisions within and between vortex–antivortex pairs allows us to decouple relaxation of the vortex energy due to sound emission and that due to interactions with normal fluid (that is, mutual friction). We directly visualize how the annihilation of vortex dipoles radiates a sound pulse. Further, our few-vortex experiments extending across different superfluid regimes reveal non-universal dissipative dynamics, suggesting that fermionic quasiparticles localized inside the vortex core contribute significantly to dissipation, thereby opening the route to exploring new pathways for quantum turbulence decay, vortex by vortex.

链接: <https://www.nature.com/articles/s41586-021-04047-4>

16. 标题: Time-Crystalline Eigenstate Order on a Quantum Processor

作者: Xiao Mi, Matteo Ippoliti, ...Pedram Roushan

摘要: Quantum many-body systems display rich phase structure in their low-temperature equilibrium states. However, much of nature is not in thermal equilibrium. Remarkably, it was recently predicted that out-of-equilibrium systems can exhibit novel dynamical phases that may otherwise be forbidden by equilibrium thermodynamics, a paradigmatic example being the discrete time crystal (DTC). Concretely, dynamical phases can be defined in periodically driven many-body localized (MBL) systems via the concept of eigenstate order. In eigenstate-ordered MBL phases, the entire many-body spectrum exhibits quantum correlations and long-range order, with characteristic signatures in late-time dynamics from all initial states. It is, however, challenging to experimentally distinguish such stable phases from transient phenomena, or from regimes in which the dynamics of few select states can mask typical behavior. Here we implement tunable CPHASE gates on an array of superconducting qubits to experimentally observe an MBL-DTC and demonstrate its characteristic spatiotemporal response for generic initial states. Our work employs a time-reversal protocol to quantify the impact of external decoherence, and leverages quantum typicality to circumvent the exponential cost of densely sampling the eigenspectrum. Furthermore, we locate the phase transition out of the DTC with an experimental finite-size analysis. These results establish a scalable approach to studying non-equilibrium phases of matter on quantum processors.

链接: <https://www.nature.com/articles/s41586-021-04257-w>

17. 标题: Artificial heavy fermions in a van der Waals heterostructure

作者: Viliam Vaňo, Mohammad Amini, Somesh C. Ganguli, Guangze Chen, Jose L. Lado, Shawulienu Kezilebieke & Peter Liljeroth

摘要: Heavy-fermion systems represent one of the paradigmatic strongly correlated states of

matter. They have been used as a platform for investigating exotic behaviour ranging from quantum criticality and non-Fermi liquid behaviour to unconventional topological superconductivity. The heavy-fermion phenomenon arises from the exchange interaction between localized magnetic moments and conduction electrons leading to Kondo lattice physics, and represents one of the long-standing open problems in quantum materials. In a Kondo lattice, the exchange interaction gives rise to a band with heavy effective mass. This intriguing phenomenology has so far been realized only in compounds containing rare-earth elements with 4f or 5f electrons. Here we realize a designer van der Waals heterostructure where artificial heavy fermions emerge from the Kondo coupling between a lattice of localized magnetic moments and itinerant electrons in a 1T/1H-TaS₂ heterostructure. We study the heterostructure using scanning tunnelling microscopy and spectroscopy and show that depending on the stacking order of the monolayers, we can reveal either the localized magnetic moments and the associated Kondo effect, or the conduction electrons with a heavy-fermion hybridization gap. Our experiments realize an ultimately tunable platform for future experiments probing enhanced many-body correlations, dimensional tuning of quantum criticality and unconventional superconductivity in two-dimensional artificial heavy-fermion systems.

链接: <https://www.nature.com/articles/s41586-021-04021-0>

18. 标题: Colossal angular magnetoresistance in ferrimagnetic nodal-line semiconductors

作者: Junho Seo, Chandan De, Hyunsoo Ha, Ji Eun Lee, Sungyu Park, Joonbum Park, Yurii Skourski, Eun Sang Choi, Bongjae Kim, Gil Young Cho, Han Woong Yeom, Sang-Wook Cheong, Jae Hoon Kim, Bohm-Jung Yang, Kyoo Kim & Jun Sung Kim

摘要: Efficient magnetic control of electronic conduction is at the heart of spintronic functionality for memory and logic applications. Magnets with topological band crossings serve as a good material platform for such control, because their topological band degeneracy can be readily tuned by spin configurations, dramatically modulating electronic conduction. Here we propose that the topological nodal-line degeneracy of spin-polarized bands in magnetic semiconductors induces an extremely large angular response of magnetotransport. Taking a layered ferrimagnet, Mn₃Si₂Te₆, and its derived compounds as a model system, we show that the topological band degeneracy, driven by chiral molecular orbital states, is lifted depending on spin orientation, which leads to a metal-insulator transition in the same ferrimagnetic phase. The resulting variation of angular magnetoresistance with rotating magnetization exceeds a trillion per cent per radian, which we call colossal angular magnetoresistance. Our findings demonstrate that magnetic nodal-line semiconductors are a promising platform for realizing extremely sensitive spin- and orbital-dependent functionalities.

链接: <https://www.nature.com/articles/s41586-021-04028-7>

19. 标题: Electron-beam energy reconstruction for neutrino oscillation measurements

作者: M. Khachatryan, A. Papadopoulou, A. Ashkenazi, F. Hauenstein, A. Nambrath, A. Hrnjic, L. B. Weinstein, O. Hen, E. Piassetzky, M. Betancourt, S. Dytman, K. Mahn, P. Coloma, the CLAS Collaboration & e4v Collaboration*

摘要: Neutrinos exist in one of three types or 'flavours'—electron, muon and tau neutrinos—and oscillate from one flavour to another when propagating through space. This phenomena is one of



the few that cannot be described using the standard model of particle physics, and so its experimental study can provide new insight into the nature of our Universe. Neutrinos oscillate as a function of their propagation distance (L) divided by their energy (E). Therefore, experiments extract oscillation parameters by measuring their energy distribution at different locations. As accelerator-based oscillation experiments cannot directly measure E , the interpretation of these experiments relies heavily on phenomenological models of neutrino–nucleus interactions to infer E . Here we exploit the similarity of electron–nucleus and neutrino–nucleus interactions, and use electron scattering data with known beam energies to test energy reconstruction methods and interaction models. We find that even in simple interactions where no pions are detected, only a small fraction of events reconstruct to the correct incident energy. More importantly, widely used interaction models reproduce the reconstructed energy distribution only qualitatively and the quality of the reproduction varies strongly with beam energy. This shows both the need and the pathway to improve current models to meet the requirements of next-generation, high-precision experiments such as Hyper-Kamiokande (Japan) and DUNE (USA).

链接: <https://www.nature.com/articles/s41586-021-04046-5>

20. 标题: Quantum gas magnifier for sub-lattice-resolved imaging of 3D quantum systems

作者: Luca Asteria, Henrik P. Zahn, Marcel N. Kosch, Klaus Sengstock & Christof Weitenberg

摘要: Imaging is central to gaining microscopic insight into physical systems, and new microscopy methods have always led to the discovery of new phenomena and a deeper understanding of them. Ultracold atoms in optical lattices provide a quantum simulation platform, featuring a variety of advanced detection tools including direct optical imaging while pinning the atoms in the lattice. However, this approach suffers from the diffraction limit, high optical density and small depth of focus, limiting it to two-dimensional (2D) systems. Here we introduce an imaging approach where matter wave optics magnifies the density distribution before optical imaging, allowing 2D sub-lattice-spacing resolution in three-dimensional (3D) systems. By combining the site-resolved imaging with magnetic resonance techniques for local addressing of individual lattice sites, we demonstrate full accessibility to 2D local information and manipulation in 3D systems. We employ the high-resolution images for precision thermodynamics of Bose–Einstein condensates in optical lattices as well as studies of thermalization dynamics driven by thermal hopping. The sub-lattice resolution is demonstrated via quench dynamics within the lattice sites. The method opens the path for spatially resolved studies of new quantum many-body regimes, including exotic lattice geometries or sub-wavelength lattices, and paves the way for single-atom-resolved imaging of atomic species, where efficient laser cooling or deep optical traps are not available, but which substantially enrich the toolbox of quantum simulation of many-body systems.

链接: <https://www.nature.com/articles/s41586-021-04011-2>

IEL Top25

(来源: <http://ieeexplore.ieee.org/>)

1. **标题:** BCSE: Blockchain-based trusted service evaluation model over big data

出处: Big Data Mining and Analytics

作者: Fengyin Li; Xinying Yu; Rui Ge; Yanli Wang; Yang Cui; Huiyu Zhou

摘要: The blockchain, with its key characteristics of decentralization, persistence, anonymity, and auditability, has become a solution to overcome the overdependence and lack of trust for a traditional public key infrastructure on third-party institutions. Because of these characteristics, the blockchain is suitable for solving certain open problems in the service-oriented social network, where the unreliability of submitted reviews of service vendors can cause serious security problems. To solve the unreliability problems of submitted reviews, this paper first proposes a blockchain-based identity authentication scheme and a new trusted service evaluation model by introducing the scheme into a service evaluation model. The new trusted service evaluation model consists of the blockchain-based identity authentication scheme, evaluation submission module, and evaluation publicity module. In the proposed evaluation model, only users who have successfully been authenticated can submit reviews to service vendors. The registration and authentication records of users' identity and the reviews for service vendors are all stored in the blockchain network. The security analysis shows that this model can ensure the credibility of users' reviews for service vendors, and other users can obtain credible reviews of service vendors via the review publicity module. The experimental results also show that the proposed model has a lower review submission delay than other models.

链接: <https://ieeexplore.ieee.org/document/9663256>

2. **标题:** Toward intelligent financial advisors for identifying potential clients: A multitask perspective

出处: Big Data Mining and Analytics

作者: Qixiang Shao; Runlong Yu; Hongke Zhao; Chunli Liu; Mengyi Zhang; Hongmei Song; Qi Liu

摘要: Intelligent Financial Advisors (IFAs) in online financial applications (apps) have brought new life to personal investment by providing appropriate and high-quality portfolios for users. In real-world scenarios, identifying potential clients is a crucial issue for IFAs, i.e., identifying users who are willing to purchase the portfolios. Thus, extracting useful information from various characteristics of users and further predicting their purchase inclination are urgent. However, two critical problems encountered in real practice make this prediction task challenging, i.e., sample selection bias and data sparsity. In this study, we formalize a potential conversion relationship, i.e., user ! activated user ! client and decompose this relationship into three related tasks. Then, we propose a Multitask Feature Extraction Model (MFEM), which can leverage useful information

contained in these related tasks and learn them jointly, thereby solving the two problems simultaneously. In addition, we design a two-stage feature selection algorithm to select highly relevant user features efficiently and accurately from an incredibly huge number of user feature fields. Finally, we conduct extensive experiments on a real-world dataset provided by a famous fintech bank. Experimental results clearly demonstrate the effectiveness of MFEM.

链接: <https://ieeexplore.ieee.org/document/9663261>

3. 标题: A comparison of computational approaches for intron retention detection

出处: Big Data Mining and Analytics

作者: Jiantao Zheng; Cuixiang Lin; Zhenpeng Wu; Hong-Dong Li

摘要: Intron Retention (IR) is an alternative splicing mode through which introns are retained in mature RNAs rather than being spliced in most cases. IR has been gaining increasing attention in recent years because of its recognized association with gene expression regulation and complex diseases. Continuous efforts have been dedicated to the development of IR detection methods. These methods differ in their metrics to quantify retention propensity, performance to detect IR events, functional enrichment of detected IRs, and computational speed. A systematic experimental comparison would be valuable to the selection and use of existing methods. In this work, we conduct an experimental comparison of existing IR detection methods. Considering the unavailability of a gold standard dataset of intron retention, we compare the IR detection performance on simulation datasets. Then, we compare the IR detection results with real RNA-Seq data. We also describe the use of differential analysis methods to identify disease-associated IRs and compare differential IRs along with their Gene Ontology enrichment, which is illustrated on an Alzheimer's disease RNA-Seq dataset. We discuss key principles and features of existing approaches and outline their differences. This systematic analysis provides helpful guidance for interrogating transcriptomic data from the point of view of IR.

链接: <https://ieeexplore.ieee.org/document/9663257>

4. 标题: Sampling with prior knowledge for high-dimensional gravitational wave data analysis

出处: Big Data Mining and Analytics

作者: He Wang; Zhoujian Cao; Yue Zhou; Zong-Kuan Guo; Zhixiang Ren

摘要: Extracting knowledge from high-dimensional data has been notoriously difficult, primarily due to the so-called "curse of dimensionality" and the complex joint distributions of these dimensions. This is a particularly profound issue for high-dimensional gravitational wave data analysis where one requires to conduct Bayesian inference and estimate joint posterior distributions. In this study, we incorporate prior physical knowledge by sampling from desired interim distributions to develop the training dataset. Accordingly, the more relevant regions of the high-dimensional feature space are covered by additional data points, such that the model can learn the subtle but important details. We adapt the normalizing flow method to be more expressive and trainable, such that the information can be effectively extracted and represented by the transformation between the prior and target distributions. Once trained, our model only takes approximately 1 s on one V100 GPU to generate thousands of samples for probabilistic inference purposes. The evaluation of our approach confirms the efficacy and efficiency of gravitational wave data inferences and points to a promising direction for similar research. The source code,

specifications, and detailed procedures are publicly accessible on GitHub.

链接: <https://ieeexplore.ieee.org/document/9663260>

5. 标题: Big data with cloud computing: Discussions and challenges

出处: Big Data Mining and Analytics

作者: Amanpreet Kaur Sandhu

摘要: With the recent advancements in computer technologies, the amount of data available is increasing day by day. However, excessive amounts of data create great challenges for users. Meanwhile, cloud computing services provide a powerful environment to store large volumes of data. They eliminate various requirements, such as dedicated space and maintenance of expensive computer hardware and software. Handling big data is a time-consuming task that requires large computational clusters to ensure successful data storage and processing. In this work, the definition, classification, and characteristics of big data are discussed, along with various cloud services, such as Microsoft Azure, Google Cloud, Amazon Web Services, International Business Machine cloud, Hortonworks, and MapR. A comparative analysis of various cloud-based big data frameworks is also performed. Various research challenges are defined in terms of distributed database storage, data security, heterogeneity, and data visualization.

链接: <https://ieeexplore.ieee.org/document/9663258>

6. 标题: Exploiting more associations between slots for multi-domain dialog state tracking

出处: Big Data Mining and Analytics

作者: Hui Bai; Yan Yang; Jie Wang

摘要: Dialog State Tracking (DST) aims to extract the current state from the conversation and plays an important role in dialog systems. Existing methods usually predict the value of each slot independently and do not consider the correlations among slots, which will exacerbate the data sparsity problem because of the increased number of candidate values. In this paper, we propose a multi-domain DST model that integrates slot-relevant information. In particular, certain connections may exist among slots in different domains, and their corresponding values can be obtained through explicit or implicit reasoning. Therefore, we use the graph adjacency matrix to determine the correlation between slots, so that the slots can incorporate more slot-value transformer information. Experimental results show that our approach has performed well on the Multi-domain Wizard-Of-Oz (MultiWOZ) 2.0 and MultiWOZ2.1 datasets, demonstrating the effectiveness and necessity of incorporating slot-relevant information.

链接: <https://ieeexplore.ieee.org/document/9663259>

7. 标题: Potential failure cause identification for optical networks using deep learning with an attention mechanism

出处: Journal of Optical Communications and Networking

作者: Chunyu Zhang; Danshi Wang; Jinwei Jia; Lingling Wang; Kun Chen; Luyao Guan; Zhuo Liu; Zhiguo Zhang; Xue Chen; Min Zhang

摘要: With a focus on failure management in optical networks, we propose a potential failure cause identification scheme using an attention mechanism for optical transport network boards, leveraging actual datasets from a network operator. The attention mechanism allows the model to

dynamically pay attention to only certain input information that is closely related to the target task (failure prediction), which can be effectively applied to identify the potential cause of the failure. In this paper, two typical attention mechanisms are comparatively studied to obtain the attention weights, which are additive attention and dot-product attention. A bi-directional long short-term memory network is selected as the failure prediction model due to its superior performance in time-series processing cases, which can capture bi-directional input information. Experimental results show that the average accuracy, F1 score, and false negative and false positive rates of the proposed scheme are 98.73%, 97.19%, 2.6%, and 0.91%, respectively. Moreover, based on the attention weight, it is confirmed that the highest-relevance input feature for equipment failure is the average value of input optical power, which may be caused by disconnection of the receiving port of the board or fiber cut of the adjacent link; the next most relevant feature is the minimum value of the environmental temperature, which may be caused by a broken fan or overheated chip. It is proven that the proposed scheme can not only find potential failure causes but also improve the performance of the failure prediction model, which is significant for optical networks realizing failure diagnosis and recovery.

链接: <https://ieeexplore.ieee.org/document/9663233>

8. 标题: Experimental validation of GNP_y in a multi-vendor flex-grid flex-rate WDM optical transport scenario

出处: Journal of Optical Communications and Networking

作者: Andrea D'Amico; Elliot London; Bertrand Le Guyader; Florian Frank; Esther Le Rouzic; Erwan Pincemin; Nicolas Brochier; Vittorio Curri

摘要: We experimentally test the accuracy of a quality of transmission estimator (QoT-E) within a laboratory flex-grid flex-rate framework, considering eight multi-vendor transceivers (TRXs) with symbol rates ranging from 33 to 69 Gbaud, and variable constellations [quadrature phase shift keying, 8-quadrature amplitude modulation (QAM), and 16-QAM probabilistic constellation shaping], for data rates of 100 Gbits/s up to 300 Gbits/s, and a flex-grid wavelength division multiplexed (WDM) spectrum, with channel spacings of 50 and 75 GHz. As a QoT-E, we utilize an enhanced implementation of the open-source GNP_y project. We demonstrate that this QoT-E provides a high level of accuracy in generalized signal-to-noise ratio (GSNR) computation, with an average error value not exceeding 0.5 dB, for the scenario under investigation. These values are computed with respect to the measured bit-error ratio converted to the GSNR using the TRX model obtained via back-to-back characterization. These results demonstrate that the optimal management of flex-grid flex-rate WDM optical transport arises by managing power spectral densities instead of power per channel, as in traditional fixed-grid systems.

链接: <https://ieeexplore.ieee.org/document/9662659>

9. 标题: Neural High Order Sliding Mode Control for Doubly Fed Induction Generator based Wind Turbines

出处: IEEE Latin America Transactions

作者: Larbi Djilali; Anuar Badillo-Olvera; Yennifer Yuliana Rios; Harold López-Beltrán; Lakhdar Saihi

摘要: Wind energy has many advantages because it does not pollute and is an inexhaustible source

of energy. In this paper Neural High Order Sliding Mode (NHOSM) control is developed for Doubly Fed Induction Generator (DFIG) based Wind Turbine (WT). The stator winding is directly coupled with the main network, whereas a Back-to-Back converter is installed to connect its rotor to the grid. The proposed control scheme is composed of Recurrent High Order Neural Network (RHONN) trained with the Extended Kalman Filter (EKF), which is used to build-up the DFIG models. Based on such identifier, the High Order Sliding Mode (HOSM) using Super-Twisting (ST) algorithm is synthesized. To show the potential of the selected scheme, a comparison study considering the NHOSM, Conventional Sliding mode (CSM), and the HOSM control is done. To ensure maximum power extractions and to protect the system, the Maximum Point Power Tracking (MPPT) algorithm and the h control are also implemented. Simulation results demonstrate the effectiveness of the proposed scheme for enhancing robustness, reducing chattering, and improving quality and quantity of the generated power.

链接: <https://ieeexplore.ieee.org/document/9661461>

10. 标题: Generation of Real Datasets for Network Simulation

出处: IEEE Latin America Transactions

作者: Matheus Sanches Quessada; Douglas Lieira; Rickson Pereira; Euclides Gottsfritz; Rodolfo Meneguette

摘要: The high growth of urban centers brings several problems for the population, such as socioeconomic and health problems due to toxins, polluting gases, delay in emergency care, and the stress to which citizens are exposed to traffic. Generally, for predicting the impact of a given action in the city, simulations are used to take into account the mobility of its inhabitants. These simulations must correspond with the environment that you want to be represented. Therefore, datasets with real data, make the simulations more reliable so that the results obtained are more satisfactory. The project aims to build a dataset with real data of user locations and traffic interventions for network simulations, optimize services for intelligent transport systems, and improve urban mobility in the city of Catanduva - SP. The results were performed on the mobile application (TIMELESS) and show that it consumes few smartphone resources (data, memory, and battery) to collect and generate the data set, compared to the use of other applications in the same segment (traffic monitoring and route suggestion).

链接: <https://ieeexplore.ieee.org/document/9661462>

11. 标题: Computer System Integrated with Digital Models for Reconstruction of Underwater Structures with High Definition

出处: IEEE Latin America Transactions

作者: Leonardo Nardy; Oberdan Pinheiro; Herman Lepikson

摘要: The development of research aimed at underwater inspection of subsea equipment has been gaining importance due to the exploration of oil and gas in deep waters. Often, the lack of accurate geometric information on subsea equipment used by the oil and gas industry leads to a series of difficulties in carrying out maintenance operations on this equipment. Currently, the use of sound-based technology is used for this purpose and its limits are known. In this sense, it is necessary to explore new methods that allow generating high-resolution three-dimensional models to represent, with adequate precision, underwater structures. The general objective of this research

work presents a novel computational system that provides an accurate three-dimensional representation of structures of underwater equipment. The visualized application is in the oil exploration and production sector offshore, to fill important gap technology available for robotic underwater operations. This representation is a valuable resource to facilitate the planning and execution of the monitoring and maintenance activities in these assets. The feasibility of implementing this system is confirmed by the maps obtained during the testing phase.

链接: <https://ieeexplore.ieee.org/document/9661468>

12. 标题: Intelligent electrical pattern recognition of appliances consumption for home energy management using high resolution measurement

出处: IEEE Latin America Transactions

作者: Fernando Ulloa-Vásquez; Luis García-Santander; Dante Carrizo; Victor Heredia-Figueroa

摘要: For an efficient energy management by residential users, monitoring and control of connected household appliances is required. If the consumption pattern of each of these devices is identified, then the management will be more efficient, reducing both the billing and the CO₂ emissions. This paper proposes a model for the recognition of energy consumption patterns in household appliances, based on the capture of electrical parameters in connected appliances, through Smart Socket with an Intrusive Load Monitoring approach. The data acquisition system corresponds to an-Internet of Things (IoT) platform that uses Automatic Meter Reading devices, connected to a IoT-gateway via Wi-Fi to send data to an application on the web. For the recognition of the patterns, machine learning techniques are used. Accuracy results on pattern identification are obtained about 91% after applying a backpropagation method in an Artificial Neural Network in time basis. Through this work, the prediction of consumer categories in household appliances, with high levels of reliability and under multiple operating states, is reached. These results enhance the efficient management of energy in a Smart Home and Smart Cities environment

链接: <https://ieeexplore.ieee.org/document/9661473>

13. 标题: Modelling and forecasting for solar irradiance from solarimetric station

出处: IEEE Latin America Transactions

作者: Bruna Kariny Fontes Rodrigues; Matheus Gomes; Ângelo Marcio Oliveira Santanna; Daniel Barbosa; Luciana Martinez

摘要: This paper proposes two approaches for modeling solar irradiance time series. The first is an exploratory analysis and second is a periodic forecast model for solar irradiance data from solarimetric station in a country city of Bahia, Brazil. Two normality hypothesis tests were applied, Anderson-Darling and Shapiro-Wilk. The shape and symmetry of the data were also analyzed using boxplot and histograms to investigate the extreme points, as well as great asymmetry in the distribution of data at different times. Through adherence tests, the normal distribution of solar irradiance in most hours within the annual periodic is rejected. A study by season was carried out, which showed a different behavior in relation to the symmetry of the data, with autumn being the most uniform and spring being the most stochastic. Spring and summer presented better conditions for installation of photovoltaic plates, due to the high solar irradiance rates, and autumn and winter presented satisfactory solar irradiance to maintain this form of generation throughout the year. The

second approach is a forecast to solar irradiance in photovoltaic generation systems. The importance of this forecast type is to favor the routine of planning, operation and maintenance of these types of systems, in addition to serving as a basis for feasibility studies and expansion of solar generation. Given a stochastic resource and the periodic behavior of solar irradiance data, a periodic autoregressive model was considered; the statistics were used by the maximum likelihood method, based on hourly measurements of irradiance over a period of one year.

链接: <https://ieeexplore.ieee.org/document/9661464>

14. **标题:** Transient stability constrained optimal power flow applied to distribution systems with synchronous generators

出处: IEEE Latin America Transactions

作者: Daiane Mara Barbosa de Siqueira; Roman Kuiava; Thelma Solange Piazza Fernandes

摘要: This paper proposes a Transient Stability Constrained Optimal Power Flow (TSC-OPF) formulation in order to calculate the optimum operating point of synchronous generators in distribution networks, in terms of dispatch of their active and reactive powers. However, the problem is complex due to the high number of constraints and variables, as well as, the presence of nonlinear constraints. To circumvent these adversities, an optimization problem is proposed in this paper with the application of a set of mathematical approximations in the constraints of the active and reactive power balance equations. In addition, an approximation is explored in the swing equation of synchronous generators belonging to a group of coherent machines, particularly regarding the active power injection from the generators. The proposed TSC-OPF is tested in a 31-bus radial distribution system with two and four generators. The results show that the running time to solve the proposed optimization problem with approximations becomes smaller when compared to the time to solve it without approximations.

链接: <https://ieeexplore.ieee.org/document/9661474>

15. **标题:** Towards the Categorization of Brazilian Financial Market Headlines

出处: IEEE Latin America Transactions

作者: Matheus Schmitz; Roger Immich; Gustavo Pessin; Geraldo Pereira Rocha Filho

摘要: Financial market news portals are valuable sources of information as they hold great power over investors' decision-making processes. Due to the vast amount of text data produced by news portals, several studies have been conducted to comprehend the behavioral variations of texts and automate the categorization of short texts. However, extracting useful information that influences investors' decision-making process is not a trivial task, given that news portals use a heterogeneous and specific language for each content produced, making it challenging to generate a standard document format. This work proposes GOOSE, a solution for the cateGORizatiOn of Short texts derived from multiple sources of information, to portray the financial market's current situation. To this end, GOOSE is based on Bidirectional Long Short-Term Memory (Bi-LSTM) and GloVe Embeddings to increase reliability in the short texts classification process. That way, GOOSE obtains data from news portals, which, once combined with a word embedding mechanism, are used as input for the Bi-LSTM to classify financial market news texts. The results obtained showed that GOOSE's efficiency in categorizing texts had an accuracy of 84% but also demonstrated the feasibility of its use in the extraction of information from financial market news

portals.

链接: <https://ieeexplore.ieee.org/document/9661475>

16. 标题: Rot Corn Grain Classification by Color and Texture Analysis

出处: IEEE Latin America Transactions

作者: Gustavo Viais de Brito Silva; Franklin César Flores

摘要: Due to the constant increase in corn production and exportation volume, it becomes necessary a digital transformation and tasks automatization in this scenario. The technological artifacts are an important tool for agribusiness companies, once they can improve the controls, agility, efficacy and safety of the procedures. Although automatic operations are frequently used, some activities are still executed manually, such as the rot corn grains classification process. The classification aims to analyze the quality and characteristics of the grains according to a predefined commercial pattern, which are established by the companies that commercialize this cereal. According to the identified characteristics, the negotiation might be affected by price reduction or rejection. Therefore, performing the classification properly is essential to increase the profitability and quality of the corn sold by the companies. Thus, this work aims to introduce a methodology for automatic estimation of percentual range of rot grains by global image analysis of corn grain samples. To be closer to the real process, we diversified the rot percentage inside the images samples by weighing the grains instead of counting it. In this methodology, the images were collected by following a capturing pattern. Next, histograms of color and texture descriptors were computed to characterize the input images. Such histograms were submitted to supervised classifiers to estimate the corn grains percentual range. Several classifiers were tested (minimum distance classifier, SVM, Naive Bayes and Decision Tree) to categorize the corn grains percentual range. In these tests, SVM classifier improved by a boosting technique (AdaBoost) achieved an average accuracy up to 99.97%.

链接: <https://ieeexplore.ieee.org/document/9661459>

17. 标题: Optimization of Reclosers Placement in Distribution Networks to Improve Service Quality Indices

出处: IEEE Latin America Transactions

作者: Gustavo Adolfo Gastelbondo Mercado; Jorge Wilson Gonzalez Sanchez

摘要: The fundamental goal of an electric utility is to provide the power supply in the most reliable and economical way. However, the components of a power distribution system are exposed to faults, or service outages, which in some cases may cause the disconnection of one or more customers of the distribution system. In order to reduce the duration of faults and improve service quality indices in power networks, utilities have installed protection devices, such as reclosers, in appropriate locations in the power distribution networks, due to its ability of coordination with other device and the radial characteristics of distribution system. In addition, the recloser can clear temporary faults and isolate failed feeders without interrupting the service of the whole circuit. This paper presents a methodology for optimization of reclosers placement in distribution networks. A mathematical model of Mixed Integer Nonlinear Programming (MINLP) is used, with the purpose to minimize the SAIDI or SAIFI quality indices. For the model, an objective function is defined, with its respective restrictions to obtain the appropriate locations.

This objective function is run in the GAMS software to model and solve optimization problems. The effectiveness of the proposed approach is evaluated on a test system and in a conventional real distribution system.

链接: <https://ieeexplore.ieee.org/document/9661463>

18. 标题: Metrics proposal to measure the quality of governmental datasets

出处: IEEE Latin America Transactions

作者: Roxana Martínez; Rocío Andrea Rodríguez; Pablo Martín Vera

摘要: The government challenge is to provide citizens with information efficiently and transparently. In this context, the new challenges that arise can be considered as an opportunity to rethink the methodologies of designing and implementing public policies and promoting a State with collaborating public officials. All this leads to a new paradigm in the treatment of open and public information. Currently, data is an indispensable resource for any public management activity, so it is necessary to keep it updated and complete. Although it can be determined that more and more governments are embarking on this new concept of open data, there is still a long way to go. Several related works on this subject are increasingly focused on the quality of open data from the portals of government entities, but it is still necessary to reinforce and understand the importance of the data, that is, if a data has quality, it can be better used, manipulated and distributed to citizens for various purposes. This work focuses on the proposal of quality metrics to analyze the contents of published datasets and thus obtain an analysis to improve their dissemination and interoperability between databases and software.

链接: <https://ieeexplore.ieee.org/document/9661470>

19. 标题: Observer-Based PD Controller for a Class of High Order Linear Unstable Delayed Systems

出处: IEEE Latin America Transactions

作者: Gonzalo Duchén Sánchez; Basilio del Muro Cuellar; Juan Francisco Marquez Rubio; Martín Velasco Villa; Miguel Angel Hernández Pérez

摘要: In this paper it is considered the stabilization and control of a class of high order linear systems that are subject to constant time delay at the input-output channel. In particular, systems with two unstable poles and any number of real or complex conjugate stable poles are studied. To improve the solutions existing in the literature, a new proposal for the solution of the considered problem is taken into account consisting in the design of an observer and a ProportionalDerivative PD controller to assure stable closedloop performance, establishing by means of a frequency analysis necessary and sufficient conditions for the proposed control strategy. The proposal novelty is the inclusion of the PD control action in the observer that allows to estimate internal signals used in the solution. This configuration offers advantages in the time delay size that can be handled and on the control performance of the closed loop system. A practical design procedure is presented to determine the value of the controller gains. Numerical simulations examples are presented to show the operation of the proposal.

链接: <https://ieeexplore.ieee.org/document/9661469>



20. **标题:** Dual-Band Impedance Matching Using Folded Stubs Composed Of Periodic Structures

出处: IEEE Latin America Transactions

作者: Anna Gabrielle Sahú; Vinícius B. Ribeiro; Victor H. C. Gerólamo; Marcos Sergio Gonçalves

摘要: Impedance matching devices are essential elements in telecommunication systems. They avoid the reflection of the electromagnetic waves and promote the maximum power transference among circuits with different electric impedances. In dual-band telecommunication systems, new impedance matching techniques have been developed. In this article, the use of folded stubs composed of periodic structure is investigated. This methodology uses two stubs, one for each frequency bands. The isolation between them is achieved by the prohibited electromagnetic bands and the use of folds in the conductive strip, which form the periodic structures, allows reducing the dimensions of the device.

链接: <https://ieeexplore.ieee.org/document/9661467>

21. **标题:** A Convolutional Neural Network for Learning Local Feature Descriptors on Multispectral Images

出处: IEEE Latin America Transactions

作者: Cristiano Nunes; Flávio Pádua

摘要: This work presents a novel convolutional neural network, termed multispectral features network (MF-Net), for learning local feature descriptors in multispectral images. Unlike most existing solutions, which primarily handle images from the visible light spectrum, we propose a learning-based method that deals with image data acquired from different spectrum bands. To design our convolutional neural network, we introduce a new layer that incorporates Log-Gabor filters to enhance the network capability to work with nonlinear intensity variations in images captured from different electromagnetic frequencies spectrum. This layer, entitled mapping layer, can be easily integrated into different network architectures. To demonstrate the efficacy and limitations of our method, we went on experiments with two distinct datasets extensively used in previous works composed of image pairs from the visible spectrum and the infrared spectrum. Experimental results with datasets containing images obtained from visible light and infrared spectrum show that our method can accurately match features, outperforming some state-of-the-art learning-based algorithms.

链接: <https://ieeexplore.ieee.org/document/9661460>

22. **标题:** Simulation Tool for Hybrid AGVs based on IEC-61131

出处: IEEE Latin America Transactions

作者: Victor Ruiz Molledo; Jesus Enrique Sierra Garcia

摘要: AGVs or automatic guided vehicles are unmanned battery-powered trucks used to transport loads in logistics and production. They are equipped with a controller, normally an industrial programmable logic controller (PLC), that processes the information of the guiding sensor and computes the signals to control the motors with the aim of following the desired trajectory. The tracking error, the traveled distance, and the time to execute a task depend on the parameters of the controller. Indeed, parameters that work in a circuit may not work in a different one. Thus, the fine-tuning of the controller is a key factor. In order to improve this process, in this work, an

IEC61131-based simulation tool has been developed to evaluate the performance of the controller with different trajectories and search the configuration that provides the minimum guide error. The tool can run on a computer or on the AGVs PLC. The simulation tool can execute the same code that is running in the AGV

链接: <https://ieeexplore.ieee.org/document/9661472>

23. 标题: Rate of Change of Active Power as a Power Swing Blocking Function of Distance Relays

出处: IEEE Latin America Transactions

作者: Gustavo Marchesan; Carlos Lazaro; Ghendy Cardoso Junior; Luiz Fernando Freitas-Gutierrez; Adriano Peres de Morais

摘要: Power swings may cause undesired trips of protection relays and, consequently, shutting down power utility equipment, leading to the outage of loads. This paper presents a procedure for detecting power swings based on the rate of change of active power. When a power swing occurs, the derivative of the active power can be modeled as a sinusoidal function and, therefore, it is possible to estimate the frequency oscillation. The proposal takes advantage to this theoretical concept to detect power swings on transmission systems. Simulation results show that the developed algorithm has good performance, including research scenarios against low and large power swings. The protection relay is unblocked upon the occurrence of a short-circuit. The proposed technique is simple to implement and can be employed as a Power Swing Blocking (PSB) function to avoid misoperation of distance protection relays.

链接: <https://ieeexplore.ieee.org/document/9661465>

24. 标题: Transient Analysis of Grounding Electrodes in Multilayer Soils Using Method of Moments

出处: IEEE Latin America Transactions

作者: Anderson Ricardo Justo de Araújo; Jaimis Sajid Leon Colqui; Walter Luiz Manzi de Azevedo; Sérgio Kurokawa; Jose Pissolato Filho; Behzad Kordi

摘要: Grounding electrodes are expected to provide a low-impedance path for faults and lightning transient currents and protect the safety of electrical equipment and nearby people against dangerous induced potentials. In this context, a precise model of the grounding electrodes is needed to represent a certain electrode arrangement buried in stratified soil. This paper computes the grounding impedances of different grounding systems buried in three different soil configurations (homogeneous, 2-layer and 3-layer soil) modeled by its frequency-dependent electrical parameters. A simulation model using a commercial full-wave electromagnetic software FEKO to compute the grounding impedances is presented. Method of Moments(MoM), a frequency-domain numerical method, is employed to compute the grounding impedance in a frequency range of 100 Hz to 5 MHz. Next, the developed ground potential rise(GPR) generated by two types of lightning currents (first and subsequent return strokes) injected into these grounding systems is computed. Time-domain GPR of each grounding system is also determined using the Vector Fitting (VF) technique combined with the ATP-software. Results show that GPR waveform is reduced when frequency-dependent soils are employed. This reduction is more pronounced in homogeneous and in 2-layersoils of high and moderated resistivity whereas the



3-layer soil has a minor impact due to the lower soil resistivity

链接: <https://ieeexplore.ieee.org/document/9661466>

25. 标题: Trajectory Planning For Car-like Robots Through Curve Parametrization And Genetic Algorithm Optimization With Applications To Autonomous Parking

出处: IEEE Latin America Transactions

作者: Renan Vieira; Eduardo Argento; Téo Revoredo

摘要: Parallel parking a car is a difficult task and may be frustrating and stressful for the driver, while commonly causes traffic jam. One way to mitigate such negative effects is to provide vehicles with self-driving capabilities. As a cornerstone of a mobile robot's ability to move autonomously stands trajectory planning, which despite many works in the literature, is still considered an open problem especially with regards to nonholonomic vehicles such as car-like robots. Based on this scenario, this work presents a trajectory planning algorithm to parallel park car-like mobile robots based on polynomial parametrization and genetic algorithm optimization. The aim is to define a law of motion to lead the vehicle from an initial pose near a parking space to a final pose within the latter in a smooth way, with no interruption and avoiding any obstacles in the way. Simulation results validate the feasibility of the proposed algorithm which lays the foundation to broader studies.

链接: <https://ieeexplore.ieee.org/document/9661471>

ESI HOT PAPERS

(Physics)

(来源: <http://esi.incites.thomsonreuters.com>)

1 被引频次: 990

题目: GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs

作者: ABBOTT, BP; ABBOTT, R; ABBOTT, TD;

出处: PHYSICAL REVIEW X 9 (3): - SEP 4 2019

摘要: We present the results from three gravitational-wave searches for coalescing compact binaries with component masses above $1 M_{\odot}$ during the first and second observing runs of the advanced gravitational-wave detector network. During the first observing run (O1), from September 12, 2015 to January 19, 2016, gravitational waves from three binary black hole mergers were detected. The second observing run (O2), which ran from November 30, 2016 to August 25, 2017, saw the first detection of gravitational waves from a binary neutron star inspiral, in addition to the observation of gravitational waves from a total of seven binary black hole mergers, four of which we report here for the first time: GW170729, GW170809, GW170818, and GW170823. For all significant gravitational-wave events, we provide estimates of the source properties. The detected binary black holes have total masses between $18.6^{(-0.7)}_{(+3.2)} M_{\odot}$ and $84.4^{(-11.1)}_{(+15.8)} M_{\odot}$ and range in distance between $320^{(-110)}_{(+120)}$ and $2840^{(-1360)}_{(+1400)}$ Mpc. No neutron star-black hole mergers were detected. In addition to highly significant gravitational-wave events, we also provide a list of marginal event candidates with an estimated false-alarm rate less than 1 per 30 days. From these results over the first two observing runs, which include approximately one gravitational-wave detection per 15 days of data searched, we infer merger rates at the 90% confidence intervals of $110 - 3840 \text{ Gpc}^{-3} \text{ y}^{-1}$ for binary neutron stars and $9.7 - 101 \text{ Gpc}^{-3} \text{ y}^{-1}$ for binary black holes assuming fixed population distributions and determine a neutron star-black hole merger rate 90% upper limit of $610 \text{ Gpc}^{-3} \text{ y}^{-1}$.

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2 被引频次: 827

题目: Quantum supremacy using a programmable superconducting processor

作者: ARUTE, F; ARYA, K; BABBUSH, R

出处: NATURE 574 (7779): 505-+ OCT 24 2019

摘要: The promise of quantum computers is that certain computational tasks might be executed

exponentially faster on a quantum processor than on a classical processor(1). A fundamental challenge is to build a high-fidelity processor capable of running quantum algorithms in an exponentially large computational space. Here we report the use of a processor with programmable superconducting qubits(2-7) to create quantum states on 53 qubits, corresponding to a computational state-space of dimension 2^{53} (about 10^{16}). Measurements from repeated experiments sample the resulting probability distribution, which we verify using classical simulations. Our Sycamore processor takes about 200 seconds to sample one instance of a quantum circuit a million times-our benchmarks currently indicate that the equivalent task for a state-of-the-art classical supercomputer would take approximately 10,000 years. This dramatic increase in speed compared to all known classical algorithms is an experimental realization of quantum supremacy(8-14) for this specific computational task, heralding a much-anticipated computing paradigm.

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3 被引频次: 731

题目: REVIEW OF PARTICLE PHYSICS

作者: ZYLA, PA;BARNETT, RM;BERINGER, J

出处: PROGRESS OF THEORETICAL AND EXPERIMENTAL PHYSICS 2020 (8): - AUG 2020

摘要: The Review summarizes much of particle physics and cosmology. Using data from previous editions, plus 3,324 new measurements from 878 papers, we list, evaluate, and average measured properties of gauge bosons and the recently discovered Higgs boson, leptons, quarks, mesons, and baryons. We summarize searches for hypothetical particles such as supersymmetric particles, heavy bosons, axions, dark photons, etc. Particle properties and search limits are listed in Summary Tables. We give numerous tables, figures, formulae, and reviews of topics such as Higgs Boson Physics, Supersymmetry, Grand Unified Theories, Neutrino Mixing, Dark Energy, Dark Matter, Cosmology, Particle Detectors, Colliders, Probability and Statistics. Among the 120 reviews are many that are new or heavily revised, including a new review on High Energy Soft QCD and Diffraction and one on the Determination of CKM Angles from B Hadrons.

The Review is divided into two volumes. Volume 1 includes the Summary Tables and 98 review articles. Volume 2 consists of the Particle Listings and contains also 22 reviews that address specific aspects of the data presented in the Listings.

The complete Review (both volumes) is published online on the website of the Particle Data Group (pdg.lbl.gov) and in a journal. Volume 1 is available in print as the PDG Book. A Particle Physics Booklet with the Summary Tables and essential tables, figures, and equations from selected review articles is available in print and as a web version optimized for use on phones as well as an Android app.

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4 被引频次: 315

题目: Superconductors, orbital magnets and correlated states in magic-angle bilayer graphene

作者: LU, XB;STEPANOV, P;YANG, W;XIE, M;AAMIR, MA;DAS, I;URGELL, C;WATANABE, K;TANIGUCHI, T;ZHANG, GY;BACHTOLD, A;MACDONALD, AH;EFETOV, DK

出处: NATURE 574 (7780): 653-+ OCT 31 2019

摘要: Superconductivity can occur under conditions approaching broken-symmetry parent states(1). In bilayer graphene, the twisting of one layer with respect to the other at 'magic' twist angles of around 1 degree leads to the emergence of ultra-flat moire superlattice minibands. Such bands are a rich and highly tunable source of strong-correlation physics(2-5), notably superconductivity, which emerges close to interaction-induced insulating states(6,7). Here we report the fabrication of magic-angle twisted bilayer graphene devices with highly uniform twist angles. The reduction in twist-angle disorder reveals the presence of insulating states at all integer occupancies of the fourfold spin-valley degenerate flat conduction and valence bands-that is, at moire band filling factors $\nu = 0, +/- 1, +/- 2, +/- 3$. At ν approximate to -2 , superconductivity is observed below critical temperatures of up to 3 kelvin. We also observe three new superconducting domes at much lower temperatures, close to the $\nu = 0$ and $\nu = +/- 1$ insulating states. Notably, at $\nu = +/- 1$ we find states with non-zero Chern numbers. For $\nu = -1$ the insulating state exhibits a sharp hysteretic resistance enhancement when a perpendicular magnetic field greater than 3.6 tesla is applied, which is consistent with a field-driven phase transition. Our study shows that broken-symmetry states, interaction-driven insulators, orbital magnets, states with non-zero Chern numbers and superconducting domes occur frequently across a wide range of moire flat band fillings, including close to charge neutrality. This study provides a more detailed view of the phenomenology of magic-angle twisted bilayer graphene, adding to our evolving understanding of its emergent properties.

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5 被引频次: 283

题目: Current-induced spin-orbit torques in ferromagnetic and antiferromagnetic systems

作者: MANCHON, A;ZELEZNY, J;MIRON, IM;JUNGWIRTH, T;SINOVA, J;THIAVILLE, A;GARELLO, K;GAMBARDELLA, P

出处: REVIEWS OF MODERN PHYSICS 91 (3): - SEP 9 2019

摘要: Spin-orbit coupling in inversion-asymmetric magnetic crystals and structures has emerged as a powerful tool to generate complex magnetic textures, interconvert charge and spin under applied current. and control magnetization dynamics. Current-induced spin-orbit torques mediate the transfer of angular momentum from the lattice to the spin system, leading to sustained magnetic oscillations or switching of ferromagnetic as well as antiferromagnetic structures. The manipulation of magnetic order, domain walls, and skyrmions by spin-orbit torques provides

evidence of the microscopic interactions between charge and spin in a variety of materials and opens novel strategies to design spintronic devices with potentially high impact in data storage, nonvolatile logic, and magnonic applications. This paper reviews recent progress in the field of spin orbitronics, focusing on theoretical models, material properties, and experimental results obtained on bulk noncentrosymmetric conductors and multilayer heterostructures, including metals, semiconductors, and topological insulator systems. Relevant aspects for improving the understanding and optimizing the efficiency of nonequilibrium spin-orbit phenomena in future nanoscale devices are also discussed.

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6 被引频次: 261

题目: Analysis and forecast of COVID-19 spreading in China, Italy and France

作者: FANELLI, D;PIAZZA, F

出处: CHAOS SOLITONS & FRACTALS 134: - MAY 2020

摘要: In this note we analyze the temporal dynamics of the coronavirus disease 2019 outbreak in China, Italy and France in the time window 22/01 - 15/03/2020. A first analysis of simple day-lag maps points to some universality in the epidemic spreading, suggesting that simple mean-field models can be meaningfully used to gather a quantitative picture of the epidemic spreading, and notably the height and time of the peak of confirmed infected individuals. The analysis of the same data within a simple susceptible-infected-recovered-deaths model indicates that the kinetic parameter that describes the rate of recovery seems to be the same, irrespective of the country, while the infection and death rates appear to be more variable. The model places the peak in Italy around March 21st 2020, with a peak number of infected individuals of about 260 00 (not including recovered and dead) and a number of deaths at the end of the epidemics of about 18,000. Since the confirmed cases are believed to be between 10 and 20% of the real number of individuals who eventually get infected, the apparent mortality rate of COVID-19 falls between 4% and 8% in Italy, while it appears substantially lower, between 1% and 3% in China. Based on our calculations, we estimate that 2500 ventilation units should represent a fair figure for the peak requirement to be considered by health authorities in Italy for their strategic planning. Finally, a simulation of the effects of drastic containment measures on the outbreak in Italy indicates that a reduction of the infection rate indeed causes a quench of the epidemic peak. However, it is also seen that the infection rate needs to be cut down drastically and quickly to observe an appreciable decrease of the epidemic peak and mortality rate. This appears only possible through a concerted and disciplined, albeit painful, effort of the population as a whole. (C) 2020 Elsevier Ltd. All rights reserved.

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7 被引频次: 249

题目: Machine learning and the physical sciences

作者: CARLEO, G; CIRAC, I; CRANMER, K; DAUDET, L; SCHULD, M; TISHBY, N; VOGT-MARANTO, L; ZDEBOROVA, L

出处: REVIEWS OF MODERN PHYSICS 91 (4): - DEC 6 2019

摘要: Machine learning (ML) encompasses a broad range of algorithms and modeling tools used for a vast array of data processing tasks, which has entered most scientific disciplines in recent years. This article reviews in a selective way the recent research on the interface between machine learning and the physical sciences. This includes conceptual developments in ML motivated by physical insights, applications of machine learning techniques to several domains in physics, and cross fertilization between the two fields. After giving a basic notion of machine learning methods and principles, examples are described of how statistical physics is used to understand methods in ML. This review then describes applications of ML methods in particle physics and cosmology, quantum many-body physics, quantum computing, and chemical and material physics. Research and development into novel computing architectures aimed at accelerating ML are also highlighted. Each of the sections describe recent successes as well as domain-specific methodology and challenges.

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8 被引频次: 240

题目: Quantum anomalous Hall effect in intrinsic magnetic topological insulator MnBi₂Te₄

作者: DENG, YJ; YU, YJ; SHI, MZ; GUO, ZX; XU, ZH; WANG, J; CHEN, XH; ZHANG, YB

出处: SCIENCE 367 (6480): 895-+ FEB 21 2020

摘要: In a magnetic topological insulator, nontrivial band topology combines with magnetic order to produce exotic states of matter, such as quantum anomalous Hall (QAH) insulators and axion insulators. In this work, we probe quantum transport in MnBi₂Te₄ thin flakes—a topological insulator with intrinsic magnetic order. In this layered van der Waals crystal, the ferromagnetic layers couple antiparallel to each other; atomically thin MnBi₂Te₄, however, becomes ferromagnetic when the sample has an odd number of septuple layers. We observe a zero-field QAH effect in a five-septuple-layer specimen at 1.4 kelvin, and an external magnetic field further raises the quantization temperature to 6.5 kelvin by aligning all layers ferromagnetically. The results establish MnBi₂Te₄ as an ideal arena for further exploring various topological phenomena with a spontaneously broken time-reversal symmetry.

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9 被引频次: 239

题目: GW190521: A Binary Black Hole Merger with a Total Mass of 150 M_{\odot}

作者: ABBOTT, BP;ABBOTT, R;ABBOTT, TD

出处: PHYSICAL REVIEW LETTERS 125 (10): - SEP 2 2020

摘要: On May 21, 2019 at 03:02:29 UTC Advanced LIGO and Advanced Virgo observed a short duration gravitational-wave signal, GW190521, with a three-detector network signal-to-noise ratio of 14.7, and an estimated false-alarm rate of 1 in 4900 yr using a search sensitive to generic transients. If GW190521 is from a quasicircular binary inspiral, then the detected signal is consistent with the merger of two black holes with masses of $85^{(-14)}_{(+21)} M_{\odot}$ and $66^{(-18)}_{(+17)} M_{\odot}$ (90% credible intervals). We infer that the primary black hole mass lies within the gap produced by (pulsational) pair-instability supernova processes, with only a 0.32% probability of being below $65 M_{\odot}$. We calculate the mass of the remnant to be $142^{(-16)}_{(+28)} M_{\odot}$, which can be considered an intermediate mass black hole (IMBH). The luminosity distance of the source is $5.3^{(-2.6)}_{(+2.4)}$ Gpc, corresponding to a redshift of $0.82^{(-0.34)}_{(+0.28)}$. The inferred rate of mergers similar to GW190521 is $0.13^{(-0.11)}_{(+0.30)}$ Gpc⁻³ yr⁻¹.

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10 被引频次: 235

题目: Intrinsic quantized anomalous Hall effect in a moire heterostructure

作者: SERLIN, M;TSCHIRHART, CL;POLSHYN, H;ZHANG, Y;ZHU, J;WATANABE, K;TANIGUCHI, T;BALENTS, L;YOUNG, AF

出处: SCIENCE 367 (6480): 900+ FEB 21 2020

摘要: The quantum anomalous Hall (QAH) effect combines topology and magnetism to produce precisely quantized Hall resistance at zero magnetic field. We report the observation of a QAH effect in twisted bilayer graphene aligned to hexagonal boron nitride. The effect is driven by intrinsic strong interactions, which polarize the electrons into a single spin- and valley-resolved moire miniband with Chern number $C = 1$. In contrast to magnetically doped systems, the measured transport energy gap is larger than the Curie temperature for magnetic ordering, and quantization to within 0.1% of the von Klitzing constant persists to temperatures of several kelvin at zero magnetic field. Electrical currents as small as 1 nanoampere controllably switch the magnetic order between states of opposite polarization, forming an electrically rewritable magnetic memory.

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11 被引频次: 226

题目: Prediction and observation of an antiferromagnetic topological insulator

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出处: NATURE 576 (7787): 416-+ DEC 19 2019

摘要: Magnetic topological insulators are narrow-gap semiconductor materials that combine non-trivial band topology and magnetic order(1). Unlike their nonmagnetic counterparts, magnetic topological insulators may have some of the surfaces gapped, which enables a number of exotic phenomena that have potential applications in spintronics(1), such as the quantum anomalous Hall effect(2) and chiral Majorana fermions(3). So far, magnetic topological insulators have only been created by means of doping nonmagnetic topological insulators with 3d transition-metal elements; however, such an approach leads to strongly inhomogeneous magnetic(4) and electronic(5) properties of these materials, restricting the observation of important effects to very low temperatures(2,3). An intrinsic magnetic topological insulator-a stoichiometric well ordered magnetic compound-could be an ideal solution to these problems, but no such material has been observed so far. Here we predict by ab initio calculations and further confirm using various experimental techniques the realization of an antiferromagnetic topological insulator in the layered van der Waals compound MnBi₂Te₄. The antiferromagnetic ordering that MnBi₂Te₄ shows makes it invariant with respect to the combination of the time-reversal and primitive-lattice translation symmetries, giving rise to a Z(2) topological classification; Z(2) = 1 for MnBi₂Te₄, confirming its topologically nontrivial nature. Our experiments indicate that the symmetry-breaking (0001) surface of MnBi₂Te₄ exhibits a large bandgap in the topological surface state. We expect this property to eventually enable the observation of a number of fundamental phenomena, among them quantized magnetoelectric coupling(6-8) and axion electrodynamics(9,10). Other exotic phenomena could become accessible at much higher temperatures than those reached so far, such as the quantum anomalous Hall effect(2) and chiral Majorana fermions(3).

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12 被引频次: 222

题目: Phy-X / PSD: Development of a user friendly online software for calculation of parameters relevant to radiation shielding and dosimetry

作者: SAKAR, E;OZPOLAT, OF;ALIM, B;SAYYED, MI;KURUDIREK, M

出处: RADIATION PHYSICS AND CHEMISTRY 166: - JAN 2020

摘要: A user friendly online Photon Shielding and Dosimetry (PSD) software available at <https://phy-x.net/PSD> has been developed for calculation of parameters relevant to shielding and dosimetry. These parameters include linear and mass attenuation coefficients (LAC, MAC), half and tenth value layers (HVL, TVL), mean free path (MFP), effective atomic number and electron density ($Z(\text{eff})$, $N(\text{eff})$), effective conductivity ($C(\text{eff})$) energy absorption and exposure buildup factors (EABF, EBF). The software can generate data on shielding parameters in the continuous energy region (1 keV-100 GeV). Also, some well-known radioactive sources (Na-22, Fe-55, Co-60, Cd-109, I-131, Ba-133, Cs-137, Eu-152 and Am-241) along with their energies and some characteristic (K-shell) X-ray energies of Cu, Rb, Mo, Ag, Ba and Tb elements are available in the software and can be selected by the user. Thus, one can obtain the shielding parameters at photon energies available for the predefined energies. Moreover, another parameter relevant to shielding i.e. the fast neutron removal cross section (FNRCs) can be calculated for a compound or a mixture using this software. The software is freely available online after having registered to the Phy-X platform.

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13 被引频次: 221

题目: QuantumATK: an integrated platform of electronic and atomic-scale modelling tools

作者: SAKAR, E;OZPOLAT, OF;ALIM, B;SAYYED, MI;KURUDIREK, M

摘要: QuantumATK is an integrated set of atomic-scale modelling tools developed since 2003 by professional software engineers in collaboration with academic researchers. While different aspects and individual modules of the platform have been previously presented, the purpose of this paper is to give a general overview of the platform. The QuantumATK simulation engines enable electronic-structure calculations using density functional theory or tight-binding model Hamiltonians, and also offers bonded or reactive empirical force fields in many different parametrizations. Density functional theory is implemented using either a plane-wave basis or expansion of electronic states in a linear combination of atomic orbitals. The platform includes a long list of advanced modules, including Green's-function methods for electron transport

simulations and surface calculations, first-principles electron-phonon and electron-photon couplings, simulation of atomic-scale heat transport, ion dynamics, spintronics, optical properties of materials, static polarization, and more. Seamless integration of the different simulation engines into a common platform allows for easy combination of different simulation methods into complex workflows. Besides giving a general overview and presenting a number of implementation details not previously published, we also present four different application examples. These are calculations of the phonon-limited mobility of Cu, Ag and Au, electron transport in a gated 2D device, multi-model simulation of lithium ion drift through a battery cathode in an external electric field, and electronic-structure calculations of the composition-dependent band gap of SiGe alloys.

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14 被引频次: 217

题目: Symmetry and Topology in Non-Hermitian Physics

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出处: PHYSICAL REVIEW X 9 (4): - OCT 21 2019

摘要: Non-Hermiticity enriches topological phases beyond the existing Hermitian framework. Whereas their unusual features with no Hermitian counterparts were extensively explored, a full understanding about the role of symmetry in non-Hermitian physics has still been elusive, and there remains an urgent need to establish their topological classification in view of rapid theoretical and experimental progress. Here, we develop a complete theory of symmetry and topology in non-Hermitian physics. We demonstrate that non-Hermiticity ramifies the celebrated Altland-Zirnbauer symmetry classification for insulators and superconductors. In particular, charge conjugation is defined in terms of transposition rather than complex conjugation due to the lack of Hermiticity, and hence chiral symmetry becomes distinct from sublattice symmetry. It is also shown that non-Hermiticity enables a Hermitian-conjugate counterpart of the Altland-Zirnbauer symmetry. Taking into account sublattice symmetry or pseudo-Hermiticity as an additional symmetry, the total number of symmetry classes is 38 instead of 10, which describe intrinsic non-Hermitian topological phases as well as non-Hermitian random matrices. Furthermore, due to the complex nature of energy spectra, non-Hermitian systems feature two different types of complex-energy gaps, pointlike and linelike vacant regions. On the basis of these concepts and K-theory, we complete classification of non-Hermitian topological phases in arbitrary dimensions and symmetry classes. Remarkably, non-Hermitian topology depends on the type of complex-energy gaps, and multiple topological structures appear for each symmetry class and each spatial dimension, which are also illustrated in detail with concrete examples. Moreover, the bulk-boundary correspondence in non-Hermitian systems is elucidated within our framework, and symmetries preventing the non-Hermitian skin effect are identified. Our classification not only categorizes recently observed lasing and transport topological phenomena, but also predicts a new type of symmetry-protected topological lasers with lasing helical edge states and dissipative

topological superconductors with nonorthogonal Majorana edge states. Furthermore, our theory provides topological classification of Hermitian and non-Hermitian free bosons. Our work establishes a theoretical framework for the fundamental and comprehensive understanding of non-Hermitian topological phases and paves the way toward uncovering unique phenomena and functionalities that emerge from the interplay of non-Hermiticity and topology.

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15 被引频次: 210

题目: FLAG Review 2019

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出处: EUROPEAN PHYSICAL JOURNAL C 80 (2): - FEB 11 2020

摘要: We review lattice results related to pion, kaon, D-meson, B-meson, and nucleon physics with the aim of making them easily accessible to the nuclear and particle physics communities. More specifically, we report on the determination of the light-quark masses, the form factor $f_+(0)$ arising in the semileptonic $K \rightarrow \pi$ transition at zero momentum transfer, as well as the decay constant ratio $f(K) / f(\pi)$ and its consequences for the CKM matrix elements V_{us} and V_{ud} . Furthermore, we describe the results obtained on the lattice for some of the low-energy constants of $SU(2)_L \times SU(2)_R$ and $SU(3)_L \times SU(3)_R$ Chiral Perturbation Theory. We review the determination of the B-K parameter of neutral kaon mixing as well as the additional four B parameters that arise in theories of physics beyond the Standard Model. For the heavy-quark sector, we provide results for $m(c)$ and $m(b)$ as well as those for D- and B-meson decay constants, form factors, and mixing parameters. These are the heavy-quark quantities most relevant for the determination of CKM matrix elements and the global CKM unitarity-triangle fit. We review the status of lattice determinations of the strong coupling constant α_s . Finally, in this review we have added a new section reviewing results for nucleon matrix elements of the axial, scalar and tensor bilinears, both isovector and flavor diagonal.

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16 被引频次: 206

题目: Optical vortices 30 years on: OAM manipulation from topological charge to multiple singularities

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出处: LIGHT-SCIENCE & APPLICATIONS 8: - OCT 2 2019

摘要: Thirty years ago, Coulet et al. proposed that a special optical field exists in laser cavities bearing some analogy with the superfluid vortex. Since then, optical vortices have been widely studied, inspired by the hydrodynamics sharing similar mathematics. Akin to a fluid vortex with a central flow singularity, an optical vortex beam has a phase singularity with a certain topological charge, giving rise to a hollow intensity distribution. Such a beam with helical phase fronts and orbital angular momentum reveals a subtle connection between macroscopic physical optics and microscopic quantum optics. These amazing properties provide a new understanding of a wide range of optical and physical phenomena, including twisting photons, spin-orbital interactions, Bose-Einstein condensates, etc., while the associated technologies for manipulating optical vortices have become increasingly tunable and flexible. Hitherto, owing to these salient properties and optical manipulation technologies, tunable vortex beams have engendered tremendous advanced applications such as optical tweezers, high-order quantum entanglement, and nonlinear optics. This article reviews the recent progress in tunable vortex technologies along with their advanced applications.

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17 被引频次: 203

题目: Machine Learning for Fluid Mechanics

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出处: ANNUAL REVIEW OF FLUID MECHANICS, VOL 52 52: 477-508 2020

摘要: The field of fluid mechanics is rapidly advancing, driven by unprecedented volumes of data from experiments, field measurements, and large-scale simulations at multiple spatiotemporal



scales. Machine learning (ML) offers a wealth of techniques to extract information from data that can be translated into knowledge about the underlying fluid mechanics. Moreover, ML algorithms can augment domain knowledge and automate tasks related to flow control and optimization. This article presents an overview of past history, current developments, and emerging opportunities of ML for fluid mechanics. We outline fundamental ML methodologies and discuss their uses for understanding, modeling, optimizing, and controlling fluid flows. The strengths and limitations of these methods are addressed from the perspective of scientific inquiry that considers data as an inherent part of modeling, experiments, and simulations. ML provides a powerful information-processing framework that can augment, and possibly even transform, current lines of fluid mechanics research and industrial applications.

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18 被引频次: 199

题目: Efficient blue light-emitting diodes based on quantum-confined bromide perovskite nanostructures

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摘要: The emergence of inorganic-organic hybrid perovskites, a unique class of solution-processable crystalline semiconductors, provides new opportunities for large-area, low-cost and colour-saturated light-emitting diodes (LEDs) ideal for display and solid-state lighting applications(1). However, the performance of blue perovskite LEDs (PeLEDs)(2-11) is far inferior to that of their near-infrared, red and green counterparts(12-19), strongly limiting the practicality of the PeLED technology. Here, we demonstrate blue PeLEDs emitting at 483 nm with colour coordinates of (0.094, 0.184) and operating with a peak external quantum efficiency of up to 9.5% at a luminance of 54 cd m⁻². The devices have a T-50 lifetime of 250 s for an initial brightness of 100 cd m⁻². The efficient blue electroluminescence originates from a structure of quantum-confined perovskite nanoparticles embedded within quasi-two-dimensional phases with higher bandgaps, prepared by an antisolvent processing scheme. Our work paves the way towards high-performance PeLEDs in the blue region.

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19 被引频次: 198

题目: High-efficiency organic solar cells with low non-radiative recombination loss and low energetic disorder

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出处: NATURE PHOTONICS 14 (5): 300-+ MAY 2020

摘要: Energy loss within organic solar cells (OSCs) is undesirable as it reduces cell efficiency(1-4). In particular, non-radiative recombination loss(3) and energetic disorder(5), which are closely related to the tail states below the band edge and the overall photon energy loss, need to be minimized to improve cell performance. Here, we report how the use of a small-molecule acceptor with torsion-free molecular conformation can achieve a very low degree of energetic disorder and mitigate energy loss in OSCs. The resulting single-junction OSC has an energy loss due to non-radiative recombination of just 0.17 eV and a high power conversion efficiency of up to 16.54% (certified as 15.89% by the National Renewable Energy Laboratory). The findings take studies of organic photovoltaics deeper into a new regime, beyond the limits of energetic disorder and large energy offset for charge generation.

An organic solar cell designed with minimal energetic disorder exhibits very low energy loss due to non-radiative recombination and highly efficient operation.

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20 被引频次: 196

题目: A new study on the mathematical modelling of human liver with Caputo-Fabrizio fractional derivative

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出处: CHAOS SOLITONS & FRACTALS 134: - MAY 2020

摘要: In this research, we aim to propose a new fractional model for human liver involving Caputo-Fabrizio derivative with the exponential kernel. Concerning the new model, the existence of a unique solution is explored by using the Picard-Lindelof approach and the fixed-point theory. In addition, the mathematical model is implemented by the homotopy analysis transform method whose convergence is also investigated. Eventually, numerical experiments are carried out to

better illustrate the results. Comparative results with the real clinical data indicate the superiority of the new fractional model over the pre-existent integer-order model with ordinary time-derivatives. (C) 2020 Elsevier Ltd. All rights reserved.

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21 被引频次: 189

题目: Tests of general relativity with the binary black hole signals from the LIGO-Virgo catalog GWTC-1

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出处: PHYSICAL REVIEW D 100 (10): - NOV 20 2019

摘要: The detection of gravitational waves by Advanced LIGO and Advanced Virgo provides an opportunity to test general relativity in a regime that is inaccessible to traditional astronomical observations and laboratory tests. We present four tests of the consistency of the data with binary black hole gravitational waveforms predicted by general relativity. One test subtracts the best-fit waveform from the data and checks the consistency of the residual with detector noise. The second test checks the consistency of the low- and high-frequency parts of the observed signals. The third test checks that phenomenological deviations introduced in the waveform model (including in the post-Newtonian coefficients) are consistent with 0. The fourth test constrains modifications to the propagation of gravitational waves due to a modified dispersion relation, including that from a massive graviton. We present results both for individual events and also results obtained by combining together particularly strong events from the first and second observing runs of Advanced LIGO and Advanced Virgo, as collected in the catalog GWTC-1. We do not find any inconsistency of the data with the predictions of general relativity and improve our

previously presented combined constraints by factors of 1.1 to 2.5. In particular, we bound the mass of the graviton to be $m(g) \leq 4.7 \times 10^{-23} \text{ eV}/c^2$ (90% credible level), an improvement of a factor of 1.6 over our previously presented results. Additionally, we check that the four gravitational-wave events published for the first time in GWTC-1 do not lead to stronger constraints on alternative polarizations than those published previously.

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22 被引频次: 187

题目: Charge order and broken rotational symmetry in magic-angle twisted bilayer graphene

作者: JIANG, YH; LAI, XY; WATANABE, K; TANIGUCHI, T; HAULE, K; MAO, JH; ANDREI, EY

出处: NATURE 573 (7772): 91-+ SEP 5 2019

摘要: Bilayer graphene can be modified by rotating (twisting) one layer with respect to the other. The interlayer twist gives rise to a moire superlattice that affects the electronic motion and alters the band structure(1-4). Near a 'magic angle' of twist(2,4), where the emergence of a flat band causes the charge carriers to slow down(3), correlated electronic phases including Mott-like insulators and superconductors were recently discovered(5-8) by using electronic transport. These measurements revealed an intriguing similarity between magic-angle twisted bilayer graphene and high-temperature superconductors, which spurred intensive research into the underlying physical mechanism(9-14). Essential clues to this puzzle, such as the symmetry and spatial distribution of the spectral function, can be accessed through scanning tunnelling spectroscopy. Here we use scanning tunnelling microscopy and spectroscopy to visualize the local density of states and charge distribution in magic-angle twisted bilayer graphene. Doping the sample to partially fill the flat band, we observe a pseudogap phase accompanied by a global stripe charge order that breaks the rotational symmetry of the moire superlattice. Both the pseudogap and the stripe charge order disappear when the band is either empty or full. The close resemblance to similar observations in high-temperature superconductors(15-21) provides new evidence of a deeper link underlying the phenomenology of these systems.

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23 被引频次: 186

题目: Narrowband deep-blue organic light-emitting diode featuring an organoboron-based emitter

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出处: NATURE PHOTONICS 13 (10): 678-+ OCT 2019

摘要: Luminescent materials that exhibit narrowband emission are vital for full-colour displays.

Here, we report a thermally activated delayed-fluorescence material that exhibits ultra-pure blue emission with full-width at half-maximum of just 14 nm. The emitter consists of five benzene rings connected by two boron and four nitrogen atoms and two diphenylamino substituents. The multiple resonance effect of the boron and nitrogen atoms induces significant localization of the highest occupied and lowest unoccupied molecular orbitals on different atoms to minimize not only the vibronic coupling between the ground state (S-0) and the singlet excited state (S-1) but also the energy gap between the S-1 state and triplet excited state (T-1). Organic light-emitting diode devices employing the emitter emit light at 469 nm with full-width at half-maximum of 18 nm with an external quantum efficiency of 34.4% at the maximum and 26.0% at 1,000 cd m⁻².

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24 被引频次: 176

题目: Two-dimensional MXenes: From morphological to optical, electric, and magnetic properties and applications

作者: JIANG, XT; KUKLIN, AV; BAEV, A; GE, YQ; AGREN, H; ZHANG, H; PRASAD, PN

出处: PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS 848: - MAR 15 2020

摘要: MXenes, generally referring to two-dimensional (2D) transition-metal carbides, nitrides, and carbonitrides, have received tremendous attention since the first report in 2011. Extensive experimental and theoretical studies have unveiled their enormous potential for applications in optoelectronics, photonics, catalysis, and many other areas. Because of their intriguing mechanical and electronic properties, together with the richness of elemental composition and chemical decoration, MXenes are poised to provide a new 2D nanoplatform for advanced optoelectronics. This comprehensive review, intended for a broad multidisciplinary readership, highlights the state-of-the-art progress on MXene theory, materials synthesis techniques, morphology modifications, opto-electromagnetic properties, and their applications. The efforts exploring the device performance limits, steric configurations, physical mechanisms, and novel application boundaries are comprehensively discussed. The review is concluded with a compelling perspective, outlook as well as non-trivial challenges in future investigation of MXene-based nano-optoelectronics. (C) 2020 The Author(s). Published by Elsevier B.V.

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25 被引频次: 171

题目: Modulating the local coordination environment of single-atom catalysts for enhanced catalytic performance

作者: LI, XY;RONG, HP;ZHANG, JT;WANG, DS;LI, YD

出处: NANO RESEARCH 13 (7): 1842-1855 SP. ISS. SI JUL 2020

摘要: The local coordination environment of catalysts has been investigated for an extended period to obtain enhanced catalytic performance. Especially with the advancement of single-atom catalysts (SACs), research on the coordination environment has been advanced to the atomic level. The surrounding coordination atoms of central metal atoms play important roles in their catalytic activity, selectivity and stability. In recent years, remarkable improvements of the catalytic performance of SACs have been achieved by the tailoring of coordination atoms, coordination numbers and second- or higher-coordination shells, which provided new opportunities for the further development of SACs. In this review, the characterization of coordination environment, tailoring of the local coordination environment, and their related adjustable catalytic performance will be discussed. We hope this review will provide new insights on further research of SACs.

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(来源: <http://esi.incites.thomsonreuters.com>)

1 被引频次: 7807

题目: Topological insulators and superconductors

作者: QI, XL;ZHANG, SC

出处: REVIEWS OF MODERN PHYSICS 83 (4): - OCT 14 2011

摘要: Topological insulators are new states of quantum matter which cannot be adiabatically connected to conventional insulators and semiconductors. They are characterized by a full insulating gap in the bulk and gapless edge or surface states which are protected by time-reversal symmetry. These topological materials have been theoretically predicted and experimentally observed in a variety of systems, including HgTe quantum wells, BiSb alloys, and Bi₂Te₃ and Bi₂Se₃ crystals. Theoretical models, materials properties, and experimental results on two-dimensional and three-dimensional topological insulators are reviewed, and both the topological band theory and the topological field theory are discussed. Topological superconductors have a full pairing gap in the bulk and gapless surface states consisting of Majorana fermions. The theory of topological superconductors is reviewed, in close analogy to the theory of topological insulators.

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2 被引频次: 5541

题目: A roadmap for graphene

作者: NOVOSELOV, KS;FALKO, VI;COLOMBO, L;GELLERT, PR;SCHWAB, MG;KIM, K

出处: NATURE 490 (7419): 192-200 OCT 11 2012

摘要: Recent years have witnessed many breakthroughs in research on graphene (the first two-dimensional atomic crystal) as well as a significant advance in the mass production of this material. This one-atom-thick fabric of carbon uniquely combines extreme mechanical strength, exceptionally high electronic and thermal conductivities, impermeability to gases, as well as many other supreme properties, all of which make it highly attractive for numerous applications. Here we review recent progress in graphene research and in the development of production methods, and critically analyse the feasibility of various graphene applications.

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3 被引频次: 5506

题目: Van der Waals heterostructures

作者: GEIM, AK;GRIGORIEVA, IV

出处: NATURE 499 (7459): 419-425 JUL 25 2013

摘要: Research on graphene and other two-dimensional atomic crystals is intense and is likely to remain one of the leading topics in condensed matter physics and materials science for many years. Looking beyond this field, isolated atomic planes can also be reassembled into designer heterostructures made layer by layer in a precisely chosen sequence. The first, already remarkably complex, such heterostructures (often referred to as 'van der Waals') have recently been fabricated and investigated, revealing unusual properties and new phenomena. Here we review this emerging research area and identify possible future directions. With steady improvement in fabrication techniques and using graphene's springboard, van der Waals heterostructures should develop into a large field of their own.

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4 被引频次: 5494

题目: Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LH

作者: CHATRCHYAN, S;KHACHATRYAN, V;SIRUNYAN, AM

出处: PHYSICS LETTERS B 716 (1): 30-61 SEP 17 2012

摘要: Results are presented from searches for the standard model Higgs boson in proton-proton collisions at $\sqrt{s} = 7$ and 8 TeV in the Compact Muon Solenoid experiment at the LHC, using data samples corresponding to integrated luminosities of up to 5.1 fb⁻¹ at 7 TeV and 5.3 fb⁻¹ at 8 TeV. The search is performed in five decay modes: $\gamma\gamma$, ZZ, W+W-, $\tau^+\tau^-$, and $b\bar{b}$. An excess of events is observed above the expected background, with a local significance of 5.0 standard deviations, at a mass near 125 GeV, signalling the production of a new particle. The expected significance for a standard model Higgs boson of that mass is 5.8 standard deviations. The excess is most significant in the two decay modes with the best mass resolution, $\gamma\gamma$ and ZZ; a fit to these signals gives a mass of 125.3 +/- 0.4(stat.) +/- 0.5(syst.) GeV. The decay to two photons indicates that the new particle is a boson with spin different from one. (C) 2012 CERN. Published by Elsevier B.V. All rights reserved.

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5 被引频次: 4975

题目: REVIEW OF PARTICLE PHYSICS Particle Data Group

作者: OLIVE, KA;AGASHE, K;AMSLER, C



出处: CHINESE PHYSICS C 38 (9): - SEP 2014

摘要: The Review summarizes much of particle physics and cosmology. Using data from previous editions, plus 3,283 new measurements from 899 Japers, we list, evaluate, and average measured properties of gauge bosons and the recently discovered Higgs boson, leptons, quarks, mesons, and baryons. We summarize searches for hypothetical particles such as heavy neutrinos, supersymmetric and technicolor particles, axions, dark photons, etc. All the particle properties and search limits are listed in Summary Tables. We also give numerous tables, figures, formulae, and reviews of topics such as Supersymmetry, Extra Dimensions, Particle Detectors, Probability, and Statistics. Among the 112 reviews are many that are new or heavily revised including those on: Dark Energy, Higgs Boson Physics, Electroweak Model, Neutrino Cross Section Measurements, Monte Carlo Neutrino Generators, Top Quark, Dark Matter, Dynamical Electroweak Symmetry Breaking, Accelerator Physics of Colliders, High-Energy Collider Parameters, Big Bang Nucleosynthesis, Astrophysical Constants and Cosmological Parameters.

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6 被引频次: 4944

题目: Observation of Gravitational Waves from a Binary Black Hole Merger

作者: ABBOTT, BP;ABBOTT, R;ABBOTT, TD;ABERNATHY, MR

出处: PHYSICAL REVIEW LETTERS 116 (6): - FEB 11 2016

摘要: On September 14, 2015 at 09: 50: 45 UTC the two detectors of the Laser Interferometer Gravitational-Wave Observatory simultaneously observed a transient gravitational-wave signal. The signal sweeps upwards in frequency from 35 to 250 Hz with a peak gravitational-wave strain of 1.0×10^{-21} . It matches the waveform predicted by general relativity for the inspiral and merger of a pair of black holes and the ringdown of the resulting single black hole. The signal was observed with a matched-filter signal-to-noise ratio of 24 and a false alarm rate estimated to be less than 1 event per 203 000 years, equivalent to a significance greater than 5.1 sigma. The source lies at a luminosity distance of $410^{(-180)}_{(+160)}$ Mpc corresponding to a redshift $z = 0.09^{(-0.01)}_{(+0.03)}$. In the source frame, the initial black hole masses are $36^{(-4)}_{(+5)} M_{\odot}$ and $29^{(-4)}_{(+4)} M_{\odot}$, and the final black hole mass is $62^{(-4)}_{(+4)} M_{\odot}$, with $3.0^{(-0.5)}_{(+0.5)} M_{\odot} c^2$ radiated in gravitational waves. All uncertainties define 90% credible intervals. These observations demonstrate the existence of binary stellar-mass black hole systems. This is the first direct detection of gravitational waves and the first observation of a binary black hole merger.

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7 被引频次: 4853

题目: REVIEW OF PARTICLE PHYSICS Particle Data Group

作者: BERINGER, J;ARGUIN, JF;BARNETT, RM;COPIC, K;DAHL, O;GROOM, DE;LIN,

CJ

出处: PHYSICAL REVIEW D 86 (1): - JUL 20 2012

摘要: This biennial Review summarizes much of particle physics. Using data from previous editions, plus 2658 new measurements from 644 papers, we list, evaluate, and average measured properties of gauge bosons, leptons, quarks, mesons, and baryons. We summarize searches for hypothetical particles such as Higgs bosons, heavy neutrinos, and supersymmetric particles. All the particle properties and search limits are listed in Summary Tables. We also give numerous tables, figures, formulae, and reviews of topics such as the Standard Model, particle detectors, probability, and statistics. Among the 112 reviews are many that are new or heavily revised including those on Heavy-Quark and Soft-Collinear Effective Theory, Neutrino Cross Section Measurements, Monte Carlo Event Generators, Lattice QCD, Heavy Quarkonium Spectroscopy, Top Quark, Dark Matter, V-cb & V-ub, Quantum Chromodynamics, High-Energy Collider Parameters, Astrophysical Constants, Cosmological Parameters, and Dark Matter.

A booklet is available containing the Summary Tables and abbreviated versions of some of the other sections of this full Review. All tables, listings, and reviews (and errata) are also available on the Particle Data Group website: <http://pdg.lbl.gov>.

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8 被引频次: 4342

题目: REVIEW OF PARTICLE PHYSICS

作者: TANABASHI, M; HAGIWARA, K; HIKASA, K

出处: PHYSICAL REVIEW D 98 (3): - AUG 17 2018

摘要: The Review summarizes much of particle physics and cosmology. Using data from previous editions, plus 2,873 new measurements from 758 papers, we list, evaluate, and average measured properties of gauge bosons and the recently discovered Higgs boson, leptons, quarks, mesons, and baryons. We summarize searches for hypothetical particles such as supersymmetric particles, heavy bosons, axions, dark photons, etc. Particle properties and search limits are listed in Summary Tables. We give numerous tables, figures, formulae, and reviews of topics such as Higgs Boson Physics, Supersymmetry, Grand Unified Theories, Neutrino Mixing, Dark Energy, Dark Matter, Cosmology, Particle Detectors, Colliders, Probability and Statistics. Among the 118 reviews are many that are new or heavily revised, including a new review on Neutrinos in Cosmology.

Starting with this edition, the Review is divided into two volumes. Volume 1 includes the Summary Tables and all review articles. Volume 2 consists of the Particle Listings. Review articles that were previously part of the Listings are now included in volume 1.

The complete Review (both volumes) is published online on the website of the Particle Data Group (<http://pdg.lbl.gov>) and in a journal. Volume 1 is available in print as the PDG Book. A Particle Physics Booklet with the Summary Tables and essential tables, figures, and equations from selected review articles is also available.



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9 被引频次: 3832

题目: REVIEW OF PARTICLE PHYSICS Particle Data Group

作者: PATRIGNANI, C;AGASHE, K;AIELLI, G;AMSLER, C;ANTONELLI, M

出处: CHINESE PHYSICS C 40 (10): - OCT 2016

摘要: The Review summarizes much of particle physics and cosmology. Using data from previous editions, plus 3,062 new measurements from 721 papers, we list, evaluate, and average measured properties of gauge bosons and the recently discovered Higgs boson, leptons, quarks, mesons, and baryons. We summarize searches for hypothetical particles such as supersymmetric particles, heavy bosons, axions, dark photons, etc. All the particle properties and search limits are listed in Summary Tables. We also give numerous tables, figures, formulae, and reviews of topics such as Higgs Boson Physics, Supersymmetry, Grand Unified Theories, Neutrino Mixing, Dark Energy, Dark Matter, Cosmology, Particle Detectors, Colliders, Probability and Statistics. Among the 117 reviews are many that are new or heavily revised, including new reviews on Pentaquarks and Inflation. The complete Review is published online in a journal and on the website of the Particle Data Group (<http://pdg.lbl.gov>). The printed PDG Book contains the Summary Tables and all review articles but no longer includes the detailed tables from the Particle Listings. A Booklet with the Summary Tables and abbreviated versions of some of the review articles is also available.

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10 被引频次: 3803

题目: Light Propagation with Phase Discontinuities: Generalized Laws of Reflection and Refraction

作者: YU, NF;GENEVET, P;KATS, MA;AIETA, F;TETIENNE, JP;CAPASSO, F;GABURRO, Z

出处: SCIENCE 334 (6054): 333-337 OCT 21 2011

摘要: Conventional optical components rely on gradual phase shifts accumulated during light propagation to shape light beams. New degrees of freedom are attained by introducing abrupt phase changes over the scale of the wavelength. A two-dimensional array of optical resonators with spatially varying phase response and subwavelength separation can imprint such phase discontinuities on propagating light as it traverses the interface between two media. Anomalous reflection and refraction phenomena are observed in this regime in optically thin arrays of metallic antennas on silicon with a linear phase variation along the interface, which are in excellent agreement with generalized laws derived from Fermat's principle. Phase discontinuities provide great flexibility in the design of light beams, as illustrated by the generation of optical vortices through use of planar designer metallic interfaces.

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11 被引频次: 3724

题目: Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC

作者: AAD, G;ABAJYAN, T;ABBOTT, B

出处: PHYSICS LETTERS B

摘要: A search for the Standard Model Higgs boson in proton-proton collisions with the ATLAS detector at the LHC is presented. The datasets used correspond to integrated luminosities of approximately 4.8 fb⁻¹ collected at, $\sqrt{s} = 7$ TeV in 2011 and 5.8 fb⁻¹ at $\sqrt{s} = 8$ TeV in 2012. Individual searches in the channels $H \rightarrow ZZ(\gamma\gamma) \rightarrow 4l$, $H \rightarrow \gamma\gamma$ and $H \rightarrow WW(\gamma\gamma) \rightarrow e\nu\mu\nu$ in the 8 TeV data are combined with previously published results of searches for $H \rightarrow ZZ(\gamma\gamma)$, $WW(\gamma\gamma)$, $b\bar{b}$ and $\tau^+\tau^-$ in the 7 TeV data and results from improved analyses of the $H \rightarrow ZZ(\gamma\gamma) \rightarrow 4l$ and $H \rightarrow \gamma\gamma$ channels in the 7 TeV data. Clear evidence for the production of a neutral boson with a measured mass of 126.0 \pm 0.4 (stat) \pm 0.4 (sys) GeV is presented. This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7×10^{-9} , is compatible with the production and decay of the Standard Model Higgs boson. (C) 2012 CERN. Published by Elsevier B.V. All rights reserved.

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12 被引频次: 3687

题目: The emergence of perovskite solar cells

作者: GREEN, MA;HO-BAILLIE, A;SNAITH, HJ

出处: NATURE PHOTONICS 8 (7): 506-514 JUL 2014

摘要: The past two years have seen the unprecedentedly rapid emergence of a new class of solar cell based on mixed organic-inorganic halide perovskites. Although the first efficient solid-state perovskite cells were reported only in mid-2012, extremely rapid progress was made during 2013 with energy conversion efficiencies reaching a confirmed 16.2% at the end of the year. This increased to a confirmed efficiency of 17.9% in early 2014, with unconfirmed values as high as 19.3% claimed. Moreover, a broad range of different fabrication approaches and device concepts is represented among the highest performing devices this diversity suggests that performance is still far from fully optimized. This Review briefly outlines notable achievements to date, describes the unique attributes of these perovskites leading to their rapid emergence and discusses challenges facing the successful development and commercialization of perovskite solar cells.

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13 被引频次: 3558

题目: GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral

作者: ABBOTT, BP;ABBOTT, R;ABBOTT, TD

出处: PHYSICAL REVIEW LETTERS 119 (16): - OCT 16 2017

摘要: On August 17, 2017 at 12:41:04 UTC the Advanced LIGO and Advanced Virgo gravitational-wave detectors made their first observation of a binary neutron star inspiral. The signal, GW170817, was detected with a combined signal-to-noise ratio of 32.4 and a false-alarm-rate estimate of less than one per 8.0×10^4 years. We infer the component masses of the binary to be between 0.86 and 2.26 M_{\odot} , in agreement with masses of known neutron stars. Restricting the component spins to the range inferred in binary neutron stars, we find the component masses to be in the range 1.17-1.60 M_{\odot} , with the total mass of the system $2.74(-0.01)(+0.04) M_{\odot}$. The source was localized within a sky region of 28 deg^2 (90% probability) and had a luminosity distance of $40(-14)(+8) \text{ Mpc}$, the closest and most precisely localized gravitational-wave signal yet. The association with the gamma-ray burst GRB 170817A, detected by Fermi-GBM 1.7 s after the coalescence, corroborates the hypothesis of a neutron star merger and provides the first direct evidence of a link between these mergers and short gamma-ray bursts. Subsequent identification of transient counterparts across the electromagnetic spectrum in the same location further supports the interpretation of this event as a neutron star merger. This unprecedented joint gravitational and electromagnetic observation provides insight into astrophysics, dense matter, gravitation, and cosmology.

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14 被引频次: 3298

题目: Enhanced power-conversion efficiency in polymer solar cells using an inverted device structure

作者: HE, ZC;ZHONG, CM;SU, SJ;XU, M;WU, HB;CAO, Y

出处: NATURE PHOTONICS 6 (9): 591-595 SEP 2012

摘要: Polymer-fullerene bulk heterojunction solar cells (PSCs) are currently attracting a great deal of attention and gaining increasing importance, having already shown great promise as renewable, lightweight and low-cost energy sources(1-4). Recently, the power-conversion efficiency of state-of-the-art PSCs has exceeded 8% in the scientific literature(5). However, to find viable applications for this emerging photovoltaic technology, further enhancements in the efficiency towards 10% (the threshold for commercial applications) are urgently required(6). Here, we demonstrate highly efficient PSCs with a certified efficiency of 9.2% using an inverted structure, which simultaneously offers ohmic contact for photogenerated charge-carrier collection and allows optimum photon harvest in the device. Because of the ease of use and drastic boost in efficiency provided by this device structure, this discovery could find use in fully exploiting the potential of various material systems, and also open up new opportunities to improve PSCs with a view to achieving an efficiency of 10%.



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15 被引频次: 3261

题目: Polymer solar cells

作者: LI, G;ZHU, R;YANG, Y

出处: NATURE PHOTONICS 6 (3): 153-161 MAR 2012

摘要: Recent progress in the development of polymer solar cells has improved power-conversion efficiencies from 3% to almost 9%. Based on semiconducting polymers, these solar cells are fabricated from solution-processing techniques and have unique prospects for achieving low-cost solar energy harvesting, owing to their material and manufacturing advantages. The potential applications of polymer solar cells are broad, ranging from flexible solar modules and semitransparent solar cells in windows, to building applications and even photon recycling in liquid-crystal displays. This Review covers the scientific origins and basic properties of polymer solar cell technology, material requirements and device operation mechanisms, while also providing a synopsis of major achievements in the field over the past few years. Potential future developments and the applications of this technology are also briefly discussed.

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16 被引频次: 3219

题目: The automated computation of tree-level and next-to-leading order differential cross sections, and their matching to parton shower simulations

作者: ALWALL, J;FREDERIX, R;FRIXIONE, S;HIRSCHI, V;MALTONI, F;MATTELAER, O;SHAO, HS;STELZER, T;TORRIELLI, P;ZARO, M

出处: JOURNAL OF HIGH ENERGY PHYSICS (7): - JUL 17 2014

摘要: We discuss the theoretical bases that underpin the automation of the computations of tree-level and next-to-leading order cross sections, of their matching to parton shower simulations, and of the merging of matched samples that differ by light-parton multiplicities. We present a computer program, MadGraph5_AMC@NLO, capable of handling all these computations - parton-level fixed order, shower-matched, merged - in a unified framework whose defining features are flexibility, high level of parallelisation, and human intervention limited to input physics quantities. We demonstrate the potential of the program by presenting selected phenomenological applications relevant to the LHC and to a 1-TeV e^+e^- collider. While next-to-leading order results are restricted to QCD corrections to SM processes in the first public version, we show that from the user viewpoint no changes have to be expected in the case of corrections due to any given renormalisable Lagrangian, and that the implementation of these are well under way.

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17 被引频次: 2841

题目: Topological semimetal and Fermi-arc surface states in the electronic structure of pyrochlore iridates

作者: WAN, XG;TURNER, AM;VISHWANATH, A;SAVRASOV, SY

出处: PHYSICAL REVIEW B 83 (20): - MAY 2 2011

摘要: We investigate novel phases that emerge from the interplay of electron correlations and strong spin-orbit interactions. We focus on describing the topological semimetal, a three-dimensional phase of a magnetic solid, and argue that it may be realized in a class of pyrochlore iridates (such as $Y(2)Ir(2)O(7)$) based on calculations using the LDA + U method. This state is a three-dimensional analog of graphene with linearly dispersing excitations and provides a condensed-matter realization of Weyl fermions that obeys a two-component Dirac equation. It also exhibits remarkable topological properties manifested by surface states in the form of Fermi arcs, which are impossible to realize in purely two-dimensional band structures. For intermediate correlation strengths, we find this to be the ground state of the pyrochlore iridates, coexisting with noncollinear magnetic order. A narrow window of magnetic "axion" insulator may also be present. An applied magnetic field is found to induce a metallic ground state.

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18 被引频次: 2684

题目: Van der Waals density functionals applied to solids

作者: KLIMES, J;BOWLER, DR;MICHAELIDES, A

出处: PHYSICAL REVIEW B 83 (19): - MAY 25 2011

摘要: The van der Waals density functional (vdW-DF) of M. Dion et al. [Phys. Rev. Lett. 92, 246401 (2004)] is a promising approach for including dispersion in approximate density functional theory exchange-correlation functionals. Indeed, an improved description of systems held by dispersion forces has been demonstrated in the literature. However, despite many applications, standard general tests on a broad range of materials including traditional "hard" matter such as metals, ionic compounds, and insulators are lacking. Such tests are important not least because many of the applications of the vdW-DF method focus on the adsorption of atoms and molecules on the surfaces of solids. Here we calculate the lattice constants, bulk moduli, and atomization energies for a range of solids using the original vdW-DF and several of its offspring. We find that the original vdW-DF overestimates lattice constants in a similar manner to how it overestimates binding distances for gas-phase dimers. However, some of the modified vdW functionals lead to average errors which are similar to those of PBE or better. Likewise, atomization energies that are slightly better than from PBE are obtained from the modified vdW-DFs. Although the tests reported here are for hard solids, not normally materials for which dispersion forces are thought to be important, we find a systematic improvement in cohesive

properties for the alkali metals and alkali halides when nonlocal correlations are accounted for.

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19 被引频次: 2668

题目: Coupled Spin and Valley Physics in Monolayers of MoS₂ and Other Group-VI Dichalcogenides

作者: XIAO, D;LIU, GB;FENG, WX;XU, XD;YAO, W

出处: PHYSICAL REVIEW LETTERS 108 (19): - MAY 7 2012

摘要: We show that inversion symmetry breaking together with spin-orbit coupling leads to coupled spin and valley physics in monolayers of MoS₂ and other group-VI dichalcogenides, making possible controls of spin and valley in these 2D materials. The spin-valley coupling at the valence-band edges suppresses spin and valley relaxation, as flip of each index alone is forbidden by the valley-contrasting spin splitting. Valley Hall and spin Hall effects coexist in both electron-doped and hole-doped systems. Optical interband transitions have frequency-dependent polarization selection rules which allow selective photo-excitation of carriers with various combination of valley and spin indices. Photoinduced spin Hall and valley Hall effects can generate long lived spin and valley accumulations on sample boundaries. The physics discussed here provides a route towards the integration of valleytronics and spintronics in multivalley materials with strong spin-orbit coupling and inversion symmetry breaking.

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20 被引频次: 2595

题目: High-mobility transport anisotropy and linear dichroism in few-layer black phosphorus

作者: QIAO, JS;KONG, XH;HU, ZX;YANG, F;JI, W

出处: NATURE COMMUNICATIONS 5: - JUL 2014

摘要: Two-dimensional crystals are emerging materials for nanoelectronics. Development of the field requires candidate systems with both a high carrier mobility and, in contrast to graphene, a sufficiently large electronic bandgap. Here we present a detailed theoretical investigation of the atomic and electronic structure of few-layer black phosphorus (BP) to predict its electrical and optical properties. This system has a direct bandgap, tunable from 1.51 eV for a monolayer to 0.59 eV for a five-layer sample. We predict that the mobilities are hole-dominated, rather high and highly anisotropic. The monolayer is exceptional in having an extremely high hole mobility (of



order 10,000 $\text{cm}^{-2}\text{V}^{-1}\text{s}^{-1}$) and anomalous elastic properties which reverse the anisotropy. Light absorption spectra indicate linear dichroism between perpendicular in-plane directions, which allows optical determination of the crystalline orientation and optical activation of the anisotropic transport properties. These results make few-layer BP a promising candidate for future electronics.

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21 被引频次: 2591

题目: Signatures of Majorana Fermions in Hybrid Superconductor-Semiconductor Nanowire Devices

作者: MOURIK, V; ZUO, K; FROLOV, SM; PLISSARD, SR; BAKKERS, EPAM; KOUWENHOVEN, LP

出处: SCIENCE 336 (6084): 1003-1007 MAY 25 2012

摘要: Majorana fermions are particles identical to their own antiparticles. They have been theoretically predicted to exist in topological superconductors. Here, we report electrical measurements on indium antimonide nanowires contacted with one normal (gold) and one superconducting (niobium titanium nitride) electrode. Gate voltages vary electron density and define a tunnel barrier between normal and superconducting contacts. In the presence of magnetic fields on the order of 100 millitesla, we observe bound, midgap states at zero bias voltage. These bound states remain fixed to zero bias, even when magnetic fields and gate voltages are changed over considerable ranges. Our observations support the hypothesis of Majorana fermions in nanowires coupled to superconductors.

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22 被引频次: 2554

题目: Silicene: Compelling Experimental Evidence for Graphenelike Two-Dimensional Silicon

作者: VOGT, P; DE PADOVA, P; QUARESIMA, C; AVILA, J; FRANTZESKAKIS, E; ASENSIO, MC; RESTA, A; EALET, B; LE LAY, G

出处: PHYSICAL REVIEW LETTERS 108 (15): - APR 12 2012

摘要: Because of its unique physical properties, graphene, a 2D honeycomb arrangement of carbon atoms, has attracted tremendous attention. Silicene, the graphene equivalent for silicon, could follow this trend, opening new perspectives for applications, especially due to its compatibility with Si-based electronics. Silicene has been theoretically predicted as a buckled honeycomb arrangement of Si atoms and having an electronic dispersion resembling that of relativistic Dirac fermions. Here we provide compelling evidence, from both structural and



electronic properties, for the synthesis of epitaxial silicene sheets on a silver (111) substrate, through the combination of scanning tunneling microscopy and angular-resolved photoemission spectroscopy in conjunction with calculations based on density functional theory.

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23 被引频次: 2554

题目: High-performance bulk thermoelectrics with all-scale hierarchical architectures

作者: BISWAS, K;HE, JQ;BLUM, ID;WU, CI;HOGAN, TP;SEIDMAN, DN;DRAVID, VP;KANATZIDIS, MG

出处: NATURE 489 (7416): 414-418 SEP 20 2012

摘要: With about two-thirds of all used energy being lost as waste heat, there is a compelling need for high-performance thermoelectric materials that can directly and reversibly convert heat to electrical energy. However, the practical realization of thermoelectric materials is limited by their hitherto low figure of merit, ZT , which governs the Carnot efficiency according to the second law of thermodynamics. The recent successful strategy of nanostructuring to reduce thermal conductivity has achieved record-high ZT values in the range 1.5-1.8 at 750-900 kelvin(1-3), but still falls short of the generally desired threshold value of 2. Nanostructures in bulk thermoelectrics allow effective phonon scattering of a significant portion of the phonon spectrum, but phonons with long mean free paths remain largely unaffected. Here we show that heat-carrying phonons with long mean free paths can be scattered by controlling and fine-tuning the mesoscale architecture of nanostructured thermoelectric materials. Thus, by considering sources of scattering on all relevant length scales in a hierarchical fashion-from atomic-scale lattice disorder and nanoscale endotaxial precipitates to mesoscale grain boundaries-we achieve the maximum reduction in lattice thermal conductivity and a large enhancement in the thermoelectric performance of PbTe. By taking such a panoscopic approach to the scattering of heat-carrying phonons across integrated length scales, we go beyond nanostructuring and demonstrate a ZT value of similar to 2.2 at 915 kelvin in p-type PbTe endotaxially nanostructured with SrTe at a concentration of 4 mole per cent and mesostructured with powder processing and spark plasma sintering. This increase in ZT beyond the threshold of 2 highlights the role of, and need for, multiscale hierarchical architecture in controlling phonon scattering in bulk thermoelectrics, and offers a realistic prospect of the recovery of a significant portion of waste heat.

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24 被引频次: 2509

题目: Ultralow thermal conductivity and high thermoelectric figure of merit in SnSe crystals

作者: ZHAO, LD;LO, SH;ZHANG, YS;SUN, H;TAN, GJ;UHER, C;WOLVERTON, C;DRAVID, VP;KANATZIDIS, MG

出处: NATURE 508 (7496): 373-+ APR 17 2014

摘要: The thermoelectric effect enables direct and reversible conversion between thermal and electrical energy, and provides a viable route for power generation from waste heat. The efficiency of thermoelectric materials is dictated by the dimensionless figure of merit, ZT (where Z is the figure of merit and T is absolute temperature), which governs the Carnot efficiency for heat conversion. Enhancements above the generally high threshold value of 2.5 have important implications for commercial deployment(1,2), especially for compounds free of Pb and Te. Here we report an unprecedented ZT of 2.6 ± 0.3 at 923 K, realized in SnSe single crystals measured along the b axis of the room-temperature orthorhombic unit cell. This material also shows a high ZT of 2.3 ± 0.3 along the c axis but a significantly reduced ZT of 0.8 ± 0.2 along the a axis. We attribute the remarkably high ZT along the b axis to the intrinsically ultralow lattice thermal conductivity in SnSe. The layered structure of SnSe derives from a distorted rock-salt structure, and features anomalously high Grüneisen parameters, which reflect the anharmonic and anisotropic bonding. We attribute the exceptionally low lattice thermal conductivity (0.2 ± 0.03 $\text{Wm}^{-1} \text{K}^{-1}$ at 973 K) in SnSe to the anharmonicity. These findings highlight alternative strategies to nanostructuring for achieving high thermoelectric performance.

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25 被引频次: 2425

题目: Cavity optomechanics

作者: ASPELMEYER, M;KIPPENBERG, TJ;MARQUARDT, F

出处: REVIEWS OF MODERN PHYSICS 86 (4): 1391-1452 DEC 30 2014

摘要: The field of cavity optomechanics is reviewed. This field explores the interaction between electromagnetic radiation and nanomechanical or micromechanical motion. This review covers the basics of optical cavities and mechanical resonators, their mutual optomechanical interaction mediated by the radiation-pressure force, the large variety of experimental systems which exhibit this interaction, optical measurements of mechanical motion, dynamical backaction amplification and cooling, nonlinear dynamics, multimode optomechanics, and proposals for future cavity-quantum-optomechanics experiments. In addition, the perspectives for fundamental quantum physics and for possible applications of optomechanical devices are described.

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AIAA、IAF 最新会议

AIAA

(AIAA 来源: <http://www.aiaa.org/>)

1. 会议名称: 2022 AIAA Science and Technology Forum and Exposition

会议时间: 3 January - 7 January 2022

会议地点: San Diego, CA and Online

会议简介: AIAA SciTech Forum is the world's largest event for aerospace research and development. The 2022 forum will explore the science, technologies, and policies that are shaping our industry's future and enabling sustainability.

链接:

<https://www.aiaa.org/events-learning/event/2022/01/03/default-calendar/2022-aiaa-science-and-technology-forum-and-exposition-aiaa-scitech-forum>

2. 会议名称: AIAA Mid-Atlantic Professional Section Young Professionals, Students, and Educators (YPSE) Conference

会议时间: 3 February - 4 February 2022

会议地点: Online

会议简介: The AIAA Mid-Atlantic Professional Section will host its annual Young Professionals, Students, and Educators (YPSE) Conference from 3–4 February 2022. This conference is a virtual event that provides students, young professionals, and educators an opportunity to present technical 20-minute presentations in any area of interest to the aerospace community, as well as Diversity, Equity, and Inclusion presentation for the conference DEI track. Awards will be given to exceptional technical presentations.

链接:

[https://www.aiaa.org/events-learning/event/2022/02/03/default-calendar/aiaa-mid-atlantic-professional-section-young-professionals-students-and-educators-\(ypse\)-conference](https://www.aiaa.org/events-learning/event/2022/02/03/default-calendar/aiaa-mid-atlantic-professional-section-young-professionals-students-and-educators-(ypse)-conference)

3. 会议名称: 2022 IEEE Aerospace Conference

会议时间: 5 March - 12 March 2022

会议地点: Yellowstone Conference Center, Big Sky, Montana, USA

会议简介: The International Conference for Aerospace Experts, Academics, Military Personnel, and Industry Leaders.

The international IEEE Aerospace Conference, with AIAA and PHM Society as technical cosponsors, is organized to promote interdisciplinary understanding of aerospace systems, their underlying science and technology, and their applications to government and commercial endeavors. The annual, weeklong conference, is set in a stimulating and thought provoking environment. The 2022 conference will be the 43rd.



链接:

<https://www.aiaa.org/events-learning/event/2022/03/05/default-calendar/2022-ieee-aerospace-conference>

4. 会议名称: Congressional Visits Day 2022

会议时间: 14 March - 18 March 2022

会议地点: Virtual

会议简介: Congressional Visits Day (CVD) is an annual event that gathers U.S.-based AIAA members—engineers, scientists, researchers, and students—to meet with national decision makers and discuss critical community issues in aeronautics, astronautics, and defense. Through meetings with members of Congress, legislative staff, and other key stakeholders, CVD raises awareness of the long-term value that science, engineering, and technology bring to America.

链接:

<https://www.aiaa.org/events-learning/event/2022/03/14/default-calendar/congressional-visits-day-2022>

5.会议名称: 2022 Region III Student Conference

会议时间: 25 March - 26 March 2022

会议地点: Purdue University, West Lafayette, Indiana, USA

会议简介: Region III includes Michigan, Ohio, Kentucky, Indiana, Illinois, and Wisconsin.

Cash prizes are awarded for first, second, and third place winners for each category. First-place regional winners are then invited to participate in the AIAA Foundation International Student Conference, held during the AIAA SciTech Forum each January.

Refer to the Student Conferences webpage for conference rules and FAQs.

链接:

<https://www.aiaa.org/events-learning/event/2022/03/25/default-calendar/2022-region-iii-student-conference>



IAF

(IAF 来源: <http://www.iafastro.org/>)

会议名称: INTERNATIONAL ASTRONAUTICAL CONGRESS 2022

会议时间: 18 – 22 September 2022

会议地点: Paris

会议简介: The IAF General Assembly selected Paris, France as Host City for IAC 2021 on Friday 5 October. The Hosting Organization is the Centre National d'Études Spatiales (CNES), a member of IAF since 1981. Paris hosted the first IAC ever in 1950, then in 1963 and lastly in 1982 and now will be holding the record of the city with most IACs hosted. Following the growing escalation of the Covid-19 outbreak around the world, the IAF has been forced to re-assess the overall schedule of IACs. On Wednesday 3 June 2020, an extraordinary session of the Bureau of the International Astronautical Federation (IAF) was chaired by Pascale Ehrenfreund, IAF President. The Bureau reviewed the calendar of the forthcoming editions of the International Astronautical Congress (IAC) in light of the consequences of the COVID-19 pandemic and the resulting lockdown. Paris, France will now host the IAC on 18 – 22 September 2022.

链接: <https://www.iafastro.org/events/iac/iac-2022/>

ACM 最新会议

来源：<http://www.acm.org/>

1. 会议名称：14th International Conference on COMmunication Systems & NETworkS

会议时间：January 3 – 8 2022

会议地点：Online

会议简介：COMSNETS is a premier international conference dedicated to advances in Networking and Communications Systems. The conference is a yearly event for a world-class gathering of researchers from academia and industry, practitioners, and business leaders, providing a forum for discussing cutting edge research, and directions for new innovative business and technology.

The conference will include a highly selective technical program consisting of submitted papers, a small set of invited papers on important and timely topics from well-known leaders in the field, and poster session of work in progress. Focused workshops and panel discussions will be held on emerging topics to allow for a lively exchange of ideas. International business and government leaders will be invited to share their perspectives, and will complement the technical program.

链接：<https://www.comsnets.org/>

2. 会议名称：23rd INTERNATIONAL CONFERENCE ON DISTRIBUTED COMPUTING AND NETWORKING

会议时间：4-7th January, 2022

会议地点：Online

会议简介：ICDCN, International Conference on Distributed Computing and Networking, is a premier international conference dedicated to addressing advances in Distributed Computing and Communication Networks. Over the years, it has become a leading forum for disseminating the latest research results in these fields. The 23rd edition of this conference will be held in a historical city, Delhi.

ICDCN 2022 will comprise of a highly selective technical program consisting of refereed regular and short papers, panel discussions as well as focused workshops on emerging topics about distributed computing and networking. See Call for Papers for more details. Conference proceedings will be published in the ACM Digital Library.

Selected papers will be invited for fast-track publication in Theoretical Computer Science or Pervasive and Mobile Computing journals. The conference will consider awarding a Best Paper Award.

链接：<https://icdcn2022.iiitd.edu.in/index.html>

3. 会议名称：The International Conference on High Performance Computing in Asia-Pacific Region (HPC Asia 2022)

会议时间: Jan 12-14, 2022

会议地点: Online

会议简介: High performance computing (HPC) is a key technology to solve large problems in science, engineering, and business by utilizing computing power that has been continuously evolving. The International Conference on High Performance Computing in Asia-Pacific Region (HPC Asia) is an international conference series in the Asia Pacific region on HPC technologies, fostering exchange of ideas, research results and case studies related to all issues of high performance computing.

The 5th edition, HPC Asia 2022 will be held with the motto "Stepping forward to the Post Moore Era together." Although we are now entering the Exascale era, the Post Moore era will soon follow, and HPC Asia 2022 will provide a unique opportunity to discuss the challenges towards the Post Moore era. In addition, we need to pay close attention to the integration of HPC and AI: while the "convergence" of HPC and AI has been broadly discussed, the intensive "integration" of those will be essential towards computing in the Post Moore era.

链接: <https://sighpc.ipsj.or.jp/HPCAsia2022/>

4. 会议名称: PLMW 2022

会议时间: Sun 16 - Fri 28 January 2022

会议地点: Philadelphia, Pennsylvania, United States

会议简介: The Programming Languages Mentoring Workshop is designed to broaden the exposure of attendees to research and career opportunities in the field of programming languages. Since its inception in 2012, the workshop has regularly co-located with major SIGPLAN conferences—see the workshop's SIGPLAN page for other editions. Most attendees are late-stage undergraduate students and early-stage graduate students. The workshop program will include technical sessions that cover both the history and current practice of core subfields within programming languages, mentoring sessions that cover effective habits for navigating the research landscape, and social sessions that create opportunities for attendees to interact with researchers in the field. The workshop aims to engage attendees in a process of imagining how they might contribute to our research community.

链接: <https://popl22.sigplan.org/home/PLMW-2022>

5. 会议名称: ACM International Conference on Supporting Group Work

会议时间: January 23-26, 2022

会议地点: Sanibel Island, Florida, USA

会议简介: The ACM International Conference on Supporting Group Work (GROUP) is a premier yet intimate and welcoming venue for research on Computer Supported Cooperative Work, Sociotechnical Studies, Practice-Centered Computing, Human Computer Interaction, Computer Supported Collaborative Learning, and related endeavors. GROUP 2022 works to integrate new hybrid participation formats and encourage research into broader questions across society and computing, while being truly international and interdisciplinary in organizational structure, as well as in participants.

链接: <https://group.acm.org/conferences/group22/>

6. **会议名称:** 27th Asia and South Pacific Design Automation Conference
会议时间: Jan. 17-20, 2022
会议地点: Online
会议简介: ASP-DAC 2022 is the 27th annual international conference on VLSI design automation in Asia and South Pacific region, one of the most active regions of design and fabrication of silicon chips in the world. The conference aims at providing the Asian and South Pacific CAD/DA and Design community with opportunities of presenting recent advances and with forums for future directions in technologies related to Electronic Design Automation (EDA). The format of the meeting intends to cultivate and promote an instructive and productive interchange of ideas among EDA researchers/developers and system/circuit/device designers. All scientists, engineers, and students who are interested in theoretical and practical aspects of VLSI design and design automation are welcomed to ASP-DAC.
链接: <https://aspdac2022.github.io/index.html>

7. **会议名称:** 35th Annual CCSC:Southeastern Conference
会议时间: January 28-29, 2022
会议地点: Bob Jones University
会议简介: The Consortium for Computing Sciences in Colleges (CCSC) annually sponsors regional conferences in various parts of the country. The Southeastern region traditionally holds its annual meeting in November of each year. The purpose of the conference is to promote exchange of information among small college personnel concerned with computer use in the academic environment. The target audience is faculty as well as administrators of academic computer facilities. There are numerous opportunities for students at the conference as well.
链接: <http://ccscse.org/conference.php?year=35th>

8. **会议名称:** The 27th Annual International Conference On Mobile Computing And Networking
会议时间: January 31 - February 04 2022
会议地点: New Orleans, United States
会议简介: ACM MobiCom 2021 is the twenty-seventh in a series of annual conferences sponsored by ACM SIGMOBILE dedicated to addressing the challenges in the areas of mobile computing and wireless and mobile networking. The MobiCom conference series serves as a highly selective, premier international forum addressing networks, systems, algorithms, and applications that support mobile computers and wireless networks. In addition to the regular conference program, MobiCom 2021 will include a set of workshops, research demonstrations, and a poster session that includes the ACM Student Research Competition.
链接: <https://www.sigmobile.org/mobicom/2021/>

9. **会议名称:** International Conference on Pattern Recognition Applications and Methods
会议时间: 3-5 February,2022
会议地点: Online
会议简介: The International Conference on Pattern Recognition Applications and Methods is a major point of contact between researchers, engineers and practitioners on the areas of Pattern



Recognition and Machine Learning, both from theoretical and application perspectives.

Contributions describing applications of Pattern Recognition techniques to real-world problems, interdisciplinary research, experimental and/or theoretical studies yielding new insights that advance Pattern Recognition methods are especially encouraged.

链接: <https://icpram.scitevents.org/>

10. 会议名称: 14th International Conference on Agents and Artificial Intelligence

会议时间: 3-5 February, 2022

会议地点: Online

会议简介: The purpose of the International Conference on Agents and Artificial Intelligence is to bring together researchers, engineers and practitioners interested in the theory and applications in the areas of Agents and Artificial Intelligence. Two simultaneous related tracks will be held, covering both applications and current research work. One track focuses on Agents, Multi-Agent Systems and Software Platforms, Distributed Problem Solving and Distributed AI in general. The other track focuses mainly on Artificial Intelligence, Knowledge Representation, Planning, Learning, Scheduling, Perception Reactive AI Systems, and Evolutionary Computing and other topics related to Intelligent Systems and Computational Intelligence.

链接: <https://icaart.scitevents.org/>



IQPC 最新国防会议(Defence)

IQPC 来源: <http://www.iqpc.com/>

1.会议名称: The world's premier meeting ground for the Armoured Vehicles community
会议时间: 24 - 27 January, 2022
会议地点: Twickenham Stadium, London, United Kingdom
会议简介: IAVs is the largest dedicated conference of its type, it annually brings together 650+ defence and industry leaders, with a military cohort comprising force and operational commanders, acquisition officials, requirement-setters, capability development experts and S&T architects.

链接:

https://www.defenceiq.com/events-internationalarmouredvehicles?mac=DFIQ_Events_Image_Listing&utm_medium=Portal&utm_source=defence-iq

2.会议名称: Homeland Security Week

会议时间: January 27 - 28, 2022

会议地点: Washington DC

会议简介: With a new year comes new goals, priorities and challenges for stakeholders involved in Homeland Defense and Security for the United States. This senior and expert-led Summit will highlight the ongoing efforts to empower knowledge sharing and collaboration with those across the Military, Defense, Law Enforcement, Industry and Academic sectors at the local, state and national level.

Recent developments have highlighted the need for technology, strategies and approaches to bolster the homeland security of the United States against emerging threats. This event will cover diverse topics ranging from border security, cybersecurity, counter UAS, intelligence sharing, infrastructure protection and resilience, identity technology, agency collaboration, budget planning and much more.

链接:

https://www.idga.org/events-homelandsecurityweek?mac=DFIQ_Events_Image_Listing&utm_medium=Portal&utm_source=defence-iq

3.会议名称: International Military Helicopter

会议时间: 15 - 17 February, 2022

会议地点: London

会议简介: The prospect of peer warfighting demands helicopter platforms that are faster, more agile, better-protected, more lethal and better-networked than their predecessors. If rotorcraft are to offset the effects of A2/AD by deploying dispersed, they must integrate unmanned systems as force multipliers, field air-launched effects to deliver lethality without mass and plug into an agile joint network to retain situational awareness and C2 in a contested battlespace.



链接:

https://www.defenceiq.com/events-militaryhelicopter?mac=DFIQ_Events_Image_Listing&utm_medium=Portal&utm_source=defence-iq

4.会议名称: Additive Manufacturing for Defence & Aerospace

会议时间: 22 - 24 February, 2022

会议地点: Das Privathotel Lindtner, Hamburg, Germany

会议简介: The Additive Manufacturing for Aerospace & Space conference is returning for its eighth edition. In recent years it has firmly established itself as the premier forum for AM users, R&D experts, and industry partners within the aerospace and space industry. We are delighted to host this conference in person once again in Germany.

链接:

https://www.defenceiq.com/events-additivemanufacturing?mac=DFIQ_Events_Image_Listing&utm_medium=Portal&utm_source=defence-iq

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