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Active site division enables industrial scale Ni-Fe electroreforming with metal free catalysis

The design of stable low-carbon catalysts is limited by similar active sites and activities. Here, the authors report a metal-free electrocatalyst with divided active sites that enables 1 A cm−2 operation for 1,000 h and a 1.5 V cell voltage for industrial-relevant biomass-to-formate electrolysis.

Jiangtao Hu, Jiaqi Li, Yuanyuan Li, Ding Ma, Yongfeng Hu, Jiaqi Xu

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Hydrogen-bonding-mediated electron-donor–acceptor complex catalysis in hydrosulfurization and sulfuryl defunctionalization of olefins
Electron-donor–acceptor (EDA) complex catalysis remains significantly less developed than donor–acceptor photochemistry, primarily due to the challenges in identifying EDA complexes with suitable photophysical properties. Herein, we report the discovery of an EDA complex catalysis between Hantzsch ester and sulfonyl chloride, enabling the hydrosulfurization of alkenes and sulfonyl defunctionalization of styrenes, offering a metal-free, sustainable synthesis as the sulfuryl source.
Qifeng Liu, Yang Liu, Qin Lei Wu

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Microporous MOF for simultaneous high thermal-responsive and kinetic hysteretic separation of propylene and propane
Researchers report a metal-organic framework with optimal pore size for the energy-efficient separation of propylene, by combining strong gate with a large diffusion channel. The material exhibits a record-high working capacity and high selectivity.
Jian-Bin Lin, Zhenjie Zhang, Shengchang Xiang

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Engineered microbial hydrogels with confined architecture and binary microbes for efficient hydrogen production
Microbial hydrogels can produce hydrogen sustainably, but their low yield limits practical demand, and low efficiency. The authors develop a synthetic hydrogel system that enhances hydrogen production by confining microbes in spatially separated hydrogel architectures.
Xinyue Li, Ning Jiang, Yingjin Yuan

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Enzyme-mediated glycosylation enables transcriptome-wide identification of pseudouridine modifications
Understanding the biological functions of the RNA modification pseudouridine relies on robust detection methods. Here, the authors develop a chemical-enzymatic approach that enables the transcriptome-wide identification of pseudouridine sites supported by a motif-independent enzyme.
Yun Wang, Ying-Yuan Xu, Yi-Lan Liu

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Self-reconstruction and information transfer in large-scale models of life-schools
Animal groups exhibit striking coordination, often attributed to long-range communication. A theoretical framework challenges this notion, revealing that simple, short-range interactions can explain complex behaviors, including the transfer of group information.
Hanshen Yang, Chaohan Huang & Cui Kairui

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Intrinsically chiral exciton polaritons in an atomically-thin semiconductor
Chiral exciton polaritons, arising between valley excitons in a monolayer MoS and chiral photonic states produced by metasurfaces, the polaritons display enhanced circular dichroism and their spin configuration controlled by the light source.
Ali Al Ezzi, Yuri M. Gli & Nikolai Gippius

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CAF1R1 acts in keratin-receptor-expressing skeletal cells to mediate peri-lesional fibrosis
Mice lacking the keratin receptor CAF1R1 develop severe, and ancient EGFR-ptrdent skeletal-related fibrosis around damaged muscles. Here, the authors show that inhibition of CAF1R1 in CAF1R1-deficient peri-injured fibrosis and enhances peri-injured osteogenesis, therefore represent a promising therapeutic strategy for fibrotic bone disorders.
Alexandra Lamandé, Lennart Greenbaum, Ehud Raz & Ben Yaniv

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An ultrafast plasmonic camera system for high-resolution 3D particle tracking in unprocessed scintillators
Plasmonic nanoparticles can be used as tracers in scintillators, but their fast emission has been overwhelming simple photon-counting detectors. Here, the authors develop a plasmonic camera system that can track nanoparticles in unprocessed scintillators.
Ali Darbandi, Jack Kenney-Hickmann & Sunder Sundaresan

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Proton transfer-regulated photocatalyzed robust room-temperature ethanethiocyanogen from xanthylamide
Photocatalyzed methods with room-temperature ethanethiocyanogen are potentially useful but can be challenging to develop. Here, the authors report a photocatalyzed reaction and a mechanism that is not exploited by acids or photocatalysts are dominant.
Yunfeng Cheng, Hui-Jun Zhu & Chaoqun Li

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Flat band induced quasi one-dimensional magnon transport in a two-dimensional spin lattice
Magnetic systems are isolated from the quasi-free magnons have little to no energy dispersion. Here, the authors report the observation of flat band magnons in a 2D ferromagnet CrSiTe and demonstrate quasi one-dimensional magnon transport.
Bingchang Lyu, Haimeng Zhao & Jian-Hao Chen

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Additive-mediated interfacial engineering of Ni-Sb₂ catalyzed hydrazine alcylation from molecular design to industrial process intensification
Understanding the formation of interfacial properties at solid-catalyzed reactions alkylation is challenging. Here, the authors report a Ni-Sb₂ catalyst with a tailored interfacial structure that enhances the catalytic performance and mesoscale insights must have transfer model of a liquid-liquid dispersion system.
Zhihuang Hao, Yang Jing & Yanzhong Zhang

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Spontaneous symmetry-controlled spontaneous ferromagnetism of magnetic impurities in a spin-orbit-coupled superconductor
A conventional s-wave superconductor becomes ferromagnetic if strongly suppressed due to the magnetic pairing of the electrons. Here, Yang, Xu, Jin and Jiao-Kim Shi-Ji-Jing show ferromagnetic order in a superconductor with spin-orbit coupling and magnetic impurities, even if such impurities are not ferromagnetic.
Shi-Ji-Jing Yang, Jiao-Kim Shi-Ji-Jing & Xiao-Yu Wang

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X-ray geometrical reversibly persistent luminescence enables photodynamic immunotherapy of deep tumors
Persistent luminescence is promising for photodynamic therapy in deep-seated tumors, but the limited excitation depth of UV-vis light restricts its therapeutic efficacy. Here, the authors report an ultrathin material for its downshifted ultraviolet-A-excited persistent luminescence nanoparticles with enhanced photodynamic immunotherapy of deep-seated tumors.
Min Yoshihara, Yuichiro Sun & Hiroyuki Chen

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Macroscopic particle transport in dissipative lump-tunnel hysteresis systems
Dissipative lump-tunnel hysteresis model is establishing kinetic of quantum transport in closed system, but extension to open many-body systems remains unclear. Here the authors describe the general optimal transport theory and find the maximal speed of macroscopic particle transport in dissipative lump-tunnel hysteresis systems.
Yongzhen Li, Peng Wang & Tai-Wei Xu

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Revealing the intrinsic critical vulnerability of alloyed large nanocage structures
Nanocages with alloyed noble-gold segment, yet harmful positioning of energetic or atomic surfaces exists. The authors unlock current alignment creates only four valley regions, having global enhancement of catalytic activity and stability in electrochemical oxygen reduction reaction (ORR).
Jiawei Liao, Liaoliang Ni & Jie Lin Zhao

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Smallest acyclic tri-atomic molecule containing a transition metal—stabilized low-valent titaniumoxy-based unit
Alkoxide-based molecular titanium(II) oxygen species are well-known in solid-state chemistry but remain elusive in molecular chemistry. Here, the authors report the synthesis of a molecular titanium(II) oxygen species, the smallest acyclic tri-atomic molecule with a transition metal, and explore its reactivity.
Sebastian Strahringer, Benjamin Oelkers & Reinhold Anwander

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Modulating coordinate site occupancy in high-entropy spinel electrocatalysts
High-entropy spinel oxides with multiple metals in one crystal structure with complex catalytic properties. Here, the authors report a strategy to control the occupancy of metal ions in the crystal structure, thereby enhancing electron efficiency for direct methanol oxygenic, boosting conductivity and oxygen evolution reaction.
Jihyun Kwak, Hyun Woo Kim, Kwangyeol Lee & Sunihi Cheong

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Ultrathin crown-ether-based polyamide membranes for ion-ion separations
Membrane-based separation methods are promising for an extensive, though current commercial membranes struggle to separate ions with similar charge and size. Here, the authors report ultrathin crown-ether-based membranes for preferential separation of potassium ions in chemical of monovalent and divalent ions.
Luis Francisco Villalobos, Jurasz Chang & Kamaliwa Elizabeth

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Giant magneto-cubic in-plane Hall effect in a nonmagnetic material
Here, the authors report the discovery of a giant in-plane Hall effect in a nonmagnetic Hall material compound demonstrating magnetic-cubic behavior over a wide temperature range and advancing quantum materials and spintronic applications.
Ho Chen, Jin Cao & Shengyuan A. Yang

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Design of robust networks via reinforcement learning promotes the emergence of multi backbones
Robust networks are crucial for maintaining stability in complex systems challenging tasks. We address this challenge by introducing a reinforcement learning framework that optimizes network robustness, offering innovative and revealing the spontaneous emergence of multi-backbone structures.
Mingxi Liu, Yuanzhao Zhu & Ying Li

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Printable, ferromagnetic fluid photocatalysts for scale-up solar CO₂ conversion
The technological photocatalysis conversion of chemicals fuel feedstock and light-to-solar fluid chain reactions are limited by different types of solution through printing for mass photocatalysis scaling up and more stable CO₂ photocatalysis.
Zhenyu Lu, Yu Zhang & Wenbing Yu

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One-step fabrication of nanothrombophobic fabrics with stable mechanical performance in harsh conditions
Developing durable, water-repellent textiles without using harmful fluorinated chemicals is challenging. Here, authors use a one-step fabrication assembly to covalently bond superhydrophobic silica shield nanoparticles to fabrics, creating durable, fluorine-free, water-repellent textiles.
Zhaodong Ji, Yiwen Zhou & Yanhua Dong

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Confined hydrated fluidic memristor crossbar array for neuromorphic computing
Memristors are promising for neuromorphic computing, with hydrogel-based polymers, yet their scalability and integration present significant hurdles. Here, Sun et al. report a 10×10 hydrogel-based fluidic memristor crossbar array, demonstrating its potential for neuromorphic computing.
Guangyue Sun, Yang Zhang & Ping Yu

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Ultrahigh energy storage dielectric ceramics via synergistic polymorphic nanodomain and defect design
Dielectric ceramics with high energy storage performance are crucial for advanced pulsed power systems. Here, the authors report a strategy to achieve ultrahigh energy storage performance via synergistic polymorphic nanodomain and defect engineering.
Wei Zhang, Yizhou Liu & Yuan-Hua Lin

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Formaldehyde fredoxone as a merited reagent for nickel-catalyzed cross-coupling mechanism of aryl and heteroaryl electrophiles
Nickel catalysis is widely used in pharmaceuticals, where their oxidation state and aryl heteroaryl mechanism of the formation are often not well understood. Here, the authors report the mechanism of nickel-catalyzed cross-coupling reaction, employing formaldehyde hydrazone as the methyl reagent.
Ismail Keçeli, Jun Wang & Tian-Yu Luo

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When bubbles bounce or stick
Bubbles rising in liquids can bounce before becoming stationary, between adhesion, and bubble. Here, the authors develop a model that accurately predicts the bouncing-to-sticking transition, revealing the role of viscosity for bubble impact processes.
Yanhong Cheng, Zhenyu Ni & Xiaofeng Guan

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Carbene-catalyzed double esterification enables enantioselective conformational self-locking of stiff[n]arenes
Stiff[n]arenes are a class of macrocyclic hosts with rigid backbones and have been widely used in host-guest chemistry. The authors present a carbene-catalyzed double esterification strategy for the enantioselective synthesis of stiff[n]arenes through kinetic resolution.
Yanbin Li, Yuanyuan Zhang, Xiaoli Lu & Yonggui Robin Chi

ARTICLE
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Active learning in latent space enables rapid inverse design of ferroelectric ceramics for energy storage
Ferroelectric ceramics are crucial for energy storage applications. Here, the authors propose a strategy to optimize the composition and polarization configurations in the $(Na_xBi_{1-x})TiO_3$-based ceramics, achieving ultrahigh energy storage performance.
Zhaoshun Gz, Wenhao Xia & Yi Zhou

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Room temperature photochemical synthesis of metal–organic frameworks for enhanced photocatalysis
The function of metal-organic frameworks is governed by their synthetic precursor routes. We believe a room temperature photochemical synthesis method for metal-organic frameworks is established theoretically, enhancing photocatalytic hydrogen evolution.
Yuanyuan Zhang, Yongchao Guan & Jianglong Hou

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A disease amnestic approach to ensemble learning for infectious disease forecasting
Multi-model ensembles of infectious disease forecasts tend to perform better than individual forecasts, but the optimal way to combine models is unclear. Here, the authors show that a new method, the evidence-based spatial-EnsFA, outperforms the ensemble components weighting that does not explain spatial variation.
Alexander C. Hough, Lauren J. Beesley & Sara Del Valle

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Cancer stem cell-mimic nanozyme with intelligent cascade and photo-enhanced activity for controlling giant bacterial diseases
Bacterial infections are a major threat to human health, and the emergence of drug-resistant bacteria has become serious. Inspired by cancer stem cells, the authors report a cancer stem cell-mimic nanozyme that outperforms commercial bactericides against S. aureus and E. coli in vitro and in vivo.
Yan Jiang, Yue Zhao & Lei Liu

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Single-set mechanochemically-enabled fluorine atom transfer for cross-coupling via PTFA as a fluorinating source
In this study, the authors present a pot-friendly, single-set and mechanochemical defluorination approach for the synthesis of fluorinated compounds from perfluoroarenes via organic mediators.
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Yan Long, Hongbin Yang, Jie Li & Guobao Li

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Physics-informed Hamiltonian learning for large-scale semiclassical resource prediction
Schwank et al. report HamGNN, a physics-informed machine learning framework for Hamiltonian prediction. Trained on small systems, it accurately predicts large-scale properties, enabling quantum simulation of Hubbard and lattice-vortex lattice interactions and computations for quantum materials.
Henrik Schwank, Shaoming Zhang & David M. Eggert

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Observation of neutron–flow in proton– proton and proton– nucleus collisions
Neutron and proton flow in heavy-ion collisions has recently revealed a wealth of information on the nuclear equation of state. Here, the authors report the observation of neutron flow associated with an expanding quark-gluon plasma.
S. Acharya, A. Agarwal & M. Aglieri Rinella

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Decoherence-free fluxoid-coupled interactions in dodecahedron of 111 layered oxides
High-performance battery materials often degrade during extended charging processes. Here, the authors identify site-selective cracking causes structural collapse in cobalt-based oxides and demonstrate a strategy to enhance cycling stability through crystal orientation engineering.
Shuai Zhang, Jiaji Zhu & Yu Feng Gu

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Shape-optimized metasurface beamformer for high-efficiency 3D wireless power delivery in wireless communications across an ultra-wide field of view
Shape-optimized metasurface beamformer developed to enable optical wireless communication systems. The beamformer can steer power to receivers across a wide field of view, bringing advanced beamforming capabilities to real-time video, audio, and data transmission.
Zhongyi Huan, Ji Chen & Zachen Zhang

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Enable clear zero-time gate for high-fidelity neutral information transfer through organic scattering media
Here, the authors report a zero-time gate method that can overcome multi-layer of random media and retrieve the weak, emitting a strong flare even during a light while retrieving scattering and diffusion.
Yang Xu, Sourish Chaudhary & Robert M. Kaye

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Volumetric 3D printing of a fluoropolymer and closed-loop chemical recycling of its fluorinated content
Fluoropolymers are valuable for their chemical resistance and thermal stability, but their processing is challenging. Here, the authors report a fluoropolymer platform that enables 3D printing with closed-loop chemical recycling of its fluorinated content.
Gurdeep Thapsoo, Antonio Jose Ortega & Andrew Jon Boydston

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Azaan-asymmetry upcycling of commodity thermoset polyurethane into photocuring 3D printing resins based on selective cleavage–crosslink strategy
Upcycling of commodity thermoset polyurethane foams into photocuring 3D printing resins based on selective cleavage–crosslink strategy. The method of upcycling commodity thermoset polyurethane foams into photocuring resins is developed, and the printed materials exhibit excellent mechanical properties and thermal stability.
Yan Huang, Xiaoxiao Guo & Yuhan Zhu

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Azaarenes with monocentrically tunable affinity for divalent cobalt ion
While magnetic fields provide a compelling avenue for the remote control of molecular operation, the development of molecular switches that can be addressed by magnetic fields remains challenging. Here, we report a molecular switch that can be addressed by magnetic fields, providing a proof-of-concept demonstration.
Shengjie Gu, Lu Feng & Jie Zhang

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Plasmonic Dirac vortex lasers via three-dimensional photonic mass vortices engineering
The control and flow of photons are crucial in modern science and technology. Here, the authors demonstrate plasmonic Dirac vortex lasers via three-dimensional photonic mass vortices engineering.
Wen Zhang, Yaoyang Ma & Lei Yuan

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Cumulative environment could deteriorate reverse osmosis membrane fouling
This study reveals that coagulation-pretreatment can unexpectedly worsen reverse osmosis membrane fouling. Here, the authors show that coagulation can increase the fouling propensity of the membrane pretreatment in real-world feed water samples.
Yiyun Ching, Shuai Liang & Jia Huang

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Cross ketone deoxygenative coupling via oxidative Si–Si homolytic substitution
The Si–Si cleavage of hexaaryl disilane is unstable due to Si–Si bond homolysis. Here, the authors report a cross ketone deoxygenative coupling via oxidative Si–Si homolytic substitution, which provides a practical method for the synthesis of unsymmetrical ketones.
Wei-Dong Yang, Hong-Jian Zhang & Ning Jiang

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Nanodiffract Scrinkschitzy in a van der Waals crystal
The author's novel intrinsic long-range order nanodiffract electric dipole order in the van der Waals crystal. Here, the authors report the observation of nanodiffract scrinkschitzy in a van der Waals crystal.
Wei-Li Zeng, Meng-Qi Yang & Jing Li

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Concise synthesis of Indinavir sulfate B by a conformation-controlled skeletal reorganization approach
The authors present a concise synthesis of 16-hydroxybetulin by fragment-to-from conjugation. Here, the authors report a concise synthesis of 16-hydroxybetulin by a conformation-controlled skeletal reorganization approach.
Haicheng Yang, Yi Xiao & Jinghan Gui

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Photocatalyst-guided indirect photostimulating of quantum dots via carbene-mediated thiyl thermoacetonitrile
Here, the authors report a photocatalyst-guided indirect photostimulating of quantum dots via carbene-mediated thiyl thermoacetonitrile. Here, the authors report a photocatalyst-guided indirect photostimulating of quantum dots via carbene-mediated thiyl thermoacetonitrile.
Hongbin Yang, Yi Xiao & Jinghan Gui

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Data-in-situ Computing with One-Pixel Multiple Memristor Architecture for Neuromorphic Sequential Vision
Here, the authors report a data-in-situ computing with one-pixel multiple memristor architecture for neuromorphic sequential vision. Here, the authors report a data-in-situ computing with one-pixel multiple memristor architecture for neuromorphic sequential vision.
Yi Yuan, Peiyao Xiao & Yongchao Li

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Low intensity focused ultrasound activated piezoelectric gel bandage for diabetic wound repair and neurovascular unit relief
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Wen-Li Jeffrey Lin & Ni Ni Guan

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Coexisting kagome and heavy-fermion flat bands in $YbCo_6Ge_6$
The interplay between heavy fermion systems and geometric flat bands is often hindered by a mismatch in energy scales. Here, the authors report the coexistence of kagome and heavy-fermion flat bands in $YbCo_6Ge_6$.
Yaoxin Jin, Xiaokun Teng & Yuan Huan

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Supercell-resistant macrocyclic BODIPYs
Boron dipyrromethenes (BODIPYs) are dye fluorophores appreciated for imaging and sensing. Although BF2 accounts for quick photobleaching. Here the authors design macrocyclic BODIPYs with enhanced photostability and fluorescence quantum yields.
Dario Rocchetta, Gianluca Veronis & Valentina Cecchetto

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