Volume 136, Issue 25 (partial)
25 June 2026
Browse Issues | Prior
Download Extensible(beta) »

On the Cover
The Pierre Auger Observatory of cosmic-ray rays recently centered at the zenith, recorded by the Large High Altitude Air Shower Observatory (LHAASO) on December 4, 2021. Recent studies indicate the direction and magnitude of large-scale anisotropy near the zenith are consistent with a cosmic-ray origin. Cover Image: Jeffrey Lee Jenkins.

From the arXiv:
Transient Large-Scale Anisotropy in TeV Cosmic Rays due to an Interplanetary Coronal Mass Ejection
Pierre Auger Collaboration, Hawai'i Pu'ukolu Collaboration
Phys. Rev. Lett. **136**, 251002 (2026)

HIGHLIGHTED ARTICLES

GEOPHYSICS | COSMIC SUSPECTS
Transient Large-Scale Anisotropy in TeV Cosmic Rays due to an Interplanetary Coronal Mass Ejection
Zhen Cao et al. (LHAASO Collaboration)
Phys. Rev. Lett. **136**, 251002 (2026) Published 23 June, 2026

A solar storm hitting Earth appears to have reduced the amount of incoming high-energy cosmic rays, suggesting a new way of measuring solar activity.

GEOPHYSICS | COSMIC SUSPECTS
Strings from Almost Nothing
Clifford Cheung, Aaron B. Hofman, Andrew Lewis, and Nathan Sivanandam
Phys. Rev. Lett. **136**, 251101 (2026) Published 23 June, 2026

Using a "bootstrap" approach, researchers show that a small set of assumptions may actually lead to a unique theory description of certain high-energy processes.

GEOPHYSICS | COSMIC SUSPECTS
Curvature-Induced Magnon Frequency Combs
Hao Zhao, Qianqian Zhang, and Ping Yan
Phys. Rev. Lett. **136**, 256705(L) (2026) Published 23 June, 2026

A ring bump in a magnetic film expands or shrinks as an impinging spin wave with precisely spaced frequencies.

FEATURED PHYSICS | COSMIC SUSPECTS
Measures of Amplitude and Direction Consist and Compete in Non-Brownian Superposition
Ivan Agullo, Leonardo Chataignier, and Bernard S. Kay
Phys. Rev. Lett. **136**, 250201 (2026) Published 23 June, 2026

A new experiment stumbles the ability of zero particles. But measure is better in ways that depend on their previous flow.

FEATURED PHYSICS
Geometric Time-Dependent Density Functional Theory
Bo Candido, Pierfrancesco Urzija, Adjan Bastiaan Laarman, Matthias Ludwig, and Lilian Tsubaran
Phys. Rev. Lett. **136**, 250401 (2026) Published 23 June, 2026

A geometric reformulation of time-dependent density functional theory better describes nonequilibrium systems.

EDITORS' SUGGESTION
Black Hole Mergers Beyond General Relativity: A Self-Force Approach
Aussilda Corona, Andrea Nac, Adam Pound, and Barak Kriszon Nissanke
Phys. Rev. Lett. **136**, 251003(L) (2026) Published 23 June, 2026

A modular framework within the self-force formalism that applies to a large class of effective field theories of gravity in order to perform tests of general relativity with binary black hole mergers in critical for upcoming gravitational wave detectors such as LISA.

EDITORS' SUGGESTION
Thermodynamics of Black Holes: Far From Equilibrium
Jahnu Achleitner, Gustavo Dotti, and Jonathan Oppenheim
Phys. Rev. Lett. **136**, 251005(L) (2026) Published 23 June, 2026

The first law of black hole mechanics has been extended to dynamical horizons so that the law applies to black holes arbitrarily far from equilibrium, a fundamental result that formally closes the thermodynamic description of black holes extends beyond the typical stationary solutions.

EDITORS' SUGGESTION
Dissipation due to Bulk Localized Low-Energy Modes in Strongly Disordered Superconductors
Aviram Schiffer-Mossel and Ariel E. Feiguin
Phys. Rev. Lett. **136**, 256301 (2026) Published 23 June, 2026

Minimaxe dissipation in strongly disordered superconductors is driven by localized collective modes within narrow spans, a theoretical insight which provides a fresh strategy to enhance cohesion (critical in quantum devices).

EDITORS' SUGGESTION
Pattern Formation during Melting of Lamellar Eutectics
Rafael Mikhaylovich Salikhov, Ekaterina Mazurkina, Anna Ekaterina Shishkina, Sofiya Bondar-Kouzeev, and Oleksii Matveyev
Phys. Rev. Lett. **136**, 256101 (2026) Published 23 June, 2026

A microfamily of patterns emerge during melting of a two-phase eutectic solid.

EDITORS' SUGGESTION
Real-Space Dynamic Electron Correlation in Beryllium
Rashed Abou, Chaya Baumann, Miguel Ordóñez, Elisabetta Pisanty, Jan Marc Dahlke, Maria Gerlach, Maite Lewenstein, and Takashi Fukuzawa
Phys. Rev. Lett. **136**, 256401 (2026) Published 23 June, 2026

The size of the exchange-correlation hole in beryllium is about 2 Å, but it extends up to about 5 Å at the photon acceleration energy, demonstrating that electron correlations are affected significantly by electron dynamics.

EDITORS' SUGGESTION
Spontaneous Ratchet Currents and Transition Dynamics in Active Wetting
Hadi Godavarz, Robert Jack, and Michael E. Cates
Phys. Rev. Lett. **136**, 257110 (2026) Published 23 June, 2026

Active wetting is a rare surface phase transition that has remarkable similarities to critical wetting transitions in equilibrium, but it also features non-trivial differences, such as the dynamical transition pathways that would be forbidden for passive fluids.

LETTERS

Quantum Information, Science, and Technology

Probing Quantum Stories over Spacetime through Interferometry
Sofie Nguyen and Christopher Fewster
Phys. Rev. Lett. **136**, 250201 (2026) Published 23 June, 2026

Shake before Use: Universal Enhancement of Quantum Thermometry by Unitary Driving
Alexander Carrasco, Lorenzo Piovano, Diego Mata-Acevedo, Mateusz Q. A. Fiers, and Giacomo Guarnieri
Phys. Rev. Lett. **136**, 250401 (2026) Published 23 June, 2026

Trines Formation and Ordering in the Attractive SU(3) Fermi-Hubbard Model
Jonathan Sanz, Eduardo Ibarra-Garcia-Padilla, Richard T. Scalettar, and Richard R. T. Hazzard
Phys. Rev. Lett. **136**, 250402 (2026) Published 23 June, 2026

Dissipative Phase Transition of Interacting Nonreciprocal Fermions
Robert C. Spieler, Hideo Hosono, and Masaya Nakata
Phys. Rev. Lett. **136**, 250403 (2026) Published 23 June, 2026

Continuous Time Crystals as a Symmetric State and the Emergence of Critical Exceptional Points
Hongzhi Zhang, Jiahui Pan, and Yuxiang Yuxiang
Phys. Rev. Lett. **136**, 250404 (2026) Published 23 June, 2026

Crystalline Special Form Factors
Dominic Yurow and Dominic A. Rowe
Phys. Rev. Lett. **136**, 250405 (2026) Published 23 June, 2026

Squeezing-Enhanced Sensing at an Exceptional Point
Chengqing Wang, Haoyan Hu, Weiru Huang, Wenxuan Wang, Alexander Romanenko, and Yanhao Zhang
Phys. Rev. Lett. **136**, 250406 (2026) Published 23 June, 2026

Clifford Hierarchy Stabilizer Codes: Transversal Non-Clifford Gates and Magic States
Rudolf Andrzejewski, Zuanyu Zhu, and Pu Zhen Wei
Phys. Rev. Lett. **136**, 250407(L) (2026) Published 23 June, 2026

Spacetime-Inverted Sensing at an Exceptional Point
Chengqing Wang, Haoyan Hu, Weiru Huang, Wenxuan Wang, Alexander Romanenko, and Yanhao Zhang
Phys. Rev. Lett. **136**, 250408 (2026) Published 23 June, 2026

Tilted Fermionic Hamiltonians Enhance and Generalize Magnetic Order in a Correlated Aqueous Flat-Band Metal
Xiangzhou Zhang, Jiahong Zhang, Jiaxiang Zhang, Xiaoyu Chen, Yongchang Ren, Yongchao Zhao, Yongchao Yu, Chengqi Jiang, Xiuzhang Wu, Qiang, Yanfei Huang, Jin Zhu, Bingqing Liu, Liang Li, and Yanfeng Guo
Phys. Rev. Lett. **136**, 250409 (2026) Published 23 June, 2026

Topological Slot in Phononic Crystals
Qing Wang, Xinlei Zhang, Cangqian Chen, Ren Liu, Yanjun Zeng, Haibang Ye, Jiajing Ye, Jiajunqi Li, Nianchu Hu, and Yongqian Ge
Phys. Rev. Lett. **136**, 250410 (2026) Published 23 June, 2026

Acoustic Non-Abelian Topological Insulator Induced by Artificial SU(3) Gauge Fields
Wenxin Wang, Kai Liu, Chen Shuang, Li, Yanshen Li, Ze Wen Wang, Hai Zhang, Zhongqiu Liu, and Shuai Chen
Phys. Rev. Lett. **136**, 250411 (2026) Published 23 June, 2026

Machine-Learned Tuning to Preserved States for Probing Noise Resilience
Rodrigo A. Orozco, Nicolás Martínez-Vélez, Luis Delacretaz, Martín Leglise, Jonathan Conrad, and Pablo Sosa Cortés
Phys. Rev. Lett. **136**, 250412 (2026) Published 23 June, 2026

Fastest Atom Blockade in Frustrated Chiral Simulators: Spectral Fingerprints
Tianhong Li and Lukin Sertac
Phys. Rev. Lett. **136**, 250413 (2026) Published 23 June, 2026

Direct Observation of Collective Dependent Magnetic Ordering and Strong Electron-Magnon Coupling
A. Ng, A. Ghiasi, Y. Y. Chang, J. W. Kim, J. C. Hoe, S. Cao, J. W. Ko, H. Lu, J. C. Liu, B. W. Dodd, C. W. Li, Y. L. Wang, A. L. Yeng, and J. Jiang
Phys. Rev. Lett. **136**, 257101 (2026) Published 23 June, 2026

Ultrafast Magneto-Optical Fingerprints of Antiferromagnets in Mn3Sn
Xu Yang, Ningbo Zheng, Wuchenling, Xu Nuo Gao, Qingcai Jiang, Zhong Chang, Ping Tan, Yong, Yong Wei Feng, Jiang, Yue Zhang, Wenhui Jiang, Xu Nuo Gao, Wenxuan Zhao, and Zhong Chang
Phys. Rev. Lett. **136**, 257102 (2026) Published 23 June, 2026

Spectroscopic Demonstration of Emergent Photons and Spinons in a Dipolar-Octupolar Quantum Spin Liquid
Bin Gao, Zhengqiang Zhou, Tongyu Zhang, Andrey Podlesnyak, Gang Wind Chang, Yong Baek Kim, and Pengcheng Dai
Phys. Rev. Lett. **136**, 257103 (2026) Published 23 June, 2026

Observation of Antiferromagnetic Order Switching in Bulk MnTe by Polarized Neutron Diffraction
Zhiqian Liu, Wenchen Sun, Xinqiao Tanabashi, Kosuke Saito, Tian Nakajima, and Takashige Nakajima
Phys. Rev. Lett. **136**, 257104 (2026) Published 23 June, 2026

Heating the Light: Straw-Field Noise from the Emergent Photon in Quantum Spin Ice
Gerasimi K. Rizb, Jonathan N. Hallén, Michael C. Zaiatsev, Roderich Moessner, and Chris R. Laumann
Phys. Rev. Lett. **136**, 257105 (2026) Published 23 June, 2026

Cosmology, Astrophysics, and Gravitation

Search for Dark Matter Induced Airglow in Planetary Atmospheres
Gong-Bo Zhao, Yuhao Li, Lukas Wenzel-Hoppe, and Jiahui Ting
Phys. Rev. Lett. **136**, 251101 (2026) Published 23 June, 2026

GEOPHYSICS | COSMIC SUSPECTS
Transient Large-Scale Anisotropy in TeV Cosmic Rays due to an Interplanetary Coronal Mass Ejection
Zhen Cao et al. (LHAASO Collaboration)
Phys. Rev. Lett. **136**, 251002 (2026) Published 23 June, 2026

A solar storm hitting Earth appears to have reduced the amount of incoming high-energy cosmic rays, suggesting a new way of measuring solar activity.

Flexible Gravitational-Wave Parameter Estimation with Transformers
Annalena Kofler, Maximilian Dax, Stephen R. Green, Jonas Wildberger, Nicolai Gerdes, Jakob H. Macke, Jonathan Gair, Alessandro Nocera, and Bernhard Schölkopf
Phys. Rev. Lett. **136**, 251103 (2026) Published 23 June, 2026

Critical Phenomenon Inside Asymptotically Flat Black Holes with Spontaneous Scalarization
Jia-Ji Bai, and Rong-Gen Cai
Phys. Rev. Lett. **136**, 251104(L) (2026) Published 23 June, 2026

Black Hole Thermodynamics without Black Hole Solutions
Ming-Rui Ding, Shan Zhou, and Yi Li
Phys. Rev. Lett. **136**, 251105(L) (2026) Published 23 June, 2026

EDITORS' SUGGESTION
Black Hole Mergers beyond General Relativity: A Self-Force Approach
Aussilda Corona, Andrea Nac, Adam Pound, and Barak Kriszon Nissanke
Phys. Rev. Lett. **136**, 251003(L) (2026) Published 23 June, 2026

A modular framework within the self-force formalism that applies to a large class of effective field theories of gravity in order to perform tests of general relativity with binary black hole mergers is critical for upcoming gravitational wave detectors such as LISA.

EDITORS' SUGGESTION
Thermodynamics of Black Holes: Far From Equilibrium
Jahnu Achleitner, Gustavo Dotti, and Jonathan Oppenheim
Phys. Rev. Lett. **136**, 251005(L) (2026) Published 23 June, 2026

The first law of black hole mechanics has been extended to dynamical horizons so that the law applies to black holes arbitrarily far from equilibrium, a fundamental result that formally closes the thermodynamic description of black holes extends beyond the typical stationary solutions.

Quantum Damping of Cosmological Shear: A New Prediction from Loop Quantum Cosmology
Wenchang Hao, Jiaxu, Chad Vidaurre, Wenxu, Gustavo A. Alcalde, and Anzhong Wang
Phys. Rev. Lett. **136**, 251006 (2026) Published 23 June, 2026

Particles and Fields

EDITORS' SUGGESTION
Strings from Almost Nothing
Clifford Cheung, Aaron B. Hofman, Andrew Lewis, and Nathan Sivanandam
Phys. Rev. Lett. **136**, 251101 (2026) Published 23 June, 2026

Using a "bootstrap" approach, researchers show that a small set of assumptions may actually lead to a unique theory description of certain high-energy processes.

Nonperturbative Matrix Renormalization
Lorenzo Fratelli, and Fabio Anguilante, Giuseppe Ernesto, and Marc Ganiffe
Phys. Rev. Lett. **136**, 251102(L) (2026) Published 23 June, 2026

Short Strings in Three-Dimensional Anti-de Sitter Space: From Weak to Strong Coupling
Luis Apolinario, Nikolay Gromov, Bogdan Vladimirov, Z., and Dmitry Youk
Phys. Rev. Lett. **136**, 251103(L) (2026) Published 23 June, 2026

Proposal for Strong Detection of Ultralight Dark Matter via Charged Lepton Flavor Violation
Anna Bogdan Pokotilo, Pier, Saint Gaudenzio, Dario Nardo, Giovanni Grilli, Simone, and Jure Zupan
Phys. Rev. Lett. **136**, 251105 (2026) Published 23 June, 2026

Fast of Symmetry in the Neutral Decays of η'
M. Ablikim et al. (BESIII Collaboration)
Phys. Rev. Lett. **136**, 251106(L) (2026) Published 23 June, 2026

Four-Fermi Rate in Electron-Positron Annihilation at Order
Guan Zhao, Jeremy Chickens, Bilal Ilias, Anjali Dixon-Maxwell-Hand, Andy Sandoz, Hacking Sun, Hanxiao Zhang, and Zhiqing Zhang
Phys. Rev. Lett. **136**, 251107 (2026) Published 23 June, 2026

Search for the η in the Photoproduction Cross Section Measurement of at Gluon
P. Adlarson et al. (Crystal Collaboration)
Phys. Rev. Lett. **136**, 251108(L) (2026) Published 23 June, 2026

Precise OCD Predictions for Hadron-Jet Production in Collisions
Leonardo Rossi, Juan Montiel Gonzalez, Nikolas Schwarz, Alexander Huss, Francesco Hamilton, and Giovanni Stagnitto
Phys. Rev. Lett. **136**, 251109(L) (2026) Published 23 June, 2026

Nuclear Physics

Low-Energy Pion-Nucleon Distribution in Capabilities of Scissors and Octupole Resonances
Y. Tokuchi, Y. Fujita, H. Fujita, T. Adachi, S. Adachi, T. Akieda, T. Akieda, K. Ito, T. Kawabata, S. Kawase, K. Kisamori, K. Miki, S. Nakai, K. Nakanishi, H. Sakai, S. Sakaguchi, S. Sakai, Y. Sasamoto, Y. Shimizu, Y. Shoji, T. Suzuki, T. Tanaka, Y. Tanaka, T. Wakasugi, T. Yamamoto, T. Yoshida, T. Yoshida, Y. Yoshida, T. Yoshida, T. Yoshida, T