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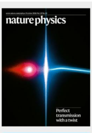

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Perfect transmission with a twist

A duality defect can be thought of as a portal to a mirror world. As a particle passes through this portal, it is transformed into a string, which illustrates how the defect connects two seemingly different descriptions of the same physical system. The cover image captures this transition, where the bright central boundary separates the particle from its string-like dual.

See Atsushi Ueda et al.

Image: Atsushi Ueda, Ghent University. Cover design: Laoise Mac Gabhann

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Editorial

Editorial
09 Oct 2026

You should advertise your conference

Participation in conferences is a great way to learn about a new field and make connections across international and disciplinary boundaries. However, that can only happen if people know where to go.

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Correspondence

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Integrate physics education research by fixing departmental structures

Nadji Belkheiri, Alexander M. Gabovich & Volodymyr Kuznetsov

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Comment

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11 Sept 2026

A digital twin should make a risky claim

As the term 'digital twin' spreads across science and technology, it risks losing scientific meaning. Such a twin should not denote just a digital replica, but a computational model that can be updated, tested against intervention and shown to fail.

Manlio De Domenico, Valeria d'Andrea ... Barbara Di Camillo

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Thesis

Thesis
09 Oct 2026

The old powers on

Mark Buchanan

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News & Views

News & Views
25 Sept 2026

Quantum field theory dynamics in trapped ions

Computing the real-time dynamics of quantum field theories is intractable for classical devices. Now, the dynamics of two quantum field theories have been observed using hybrid trapped-ion quantum simulators.

Pan-Yu Hou

News & Views
06 Oct 2026

Reactions become topological

Chemical reactions are often guided by orbital symmetries, but the usual orbital picture can fail when electrons are strongly correlated. A Green's function approach now reveals that symmetry-forbidden reactions retain a topological signature.

Norah M. Hoffmann

News & Views
10 Sept 2026

Electric fields take control of ferrons

Ferrons are the quasiparticles associated with the collective excitations of spontaneous polarization. External electric fields have now been shown to tune their properties in a nonvolatile manner.

Peiran Tong & He Tian

News & Views
14 Sept 2026

Microrotors make waves

Thousands of 3D-printed microscopic rotors spontaneously synchronize their motion when assembled into a lattice. Counterintuitively, small imperfections among individual motors drive the propagation of waves across such artificial active matter.

Martin Brandenbourger

News & Views
28 Sept 2026

Topology from disorder

Topological phases of matter have long been studied in idealized pure states at absolute zero. Two experiments now show how controlled disorder can give mixed states measurable topological features in quantum simulators.

Jens Hertkorn & Botond Oreg

News & Views
14 Sept 2026

Criticality from competition

Conformal field theories describe universal physics at quantum critical points, but it is hard to find microscopic models that realize particular field theories. Studying competing boundary conditions of topological phases provides a systematic way to build such models.

Luisa Eck

News & Views
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Lift from the flow

Debarchan Das

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Active wetting of an implanting embryo

Elizaveta Dubrovina

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Orthorhombic ice

Lishu Wu

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Research Briefings

Research Briefing
21 Aug 2026

Antidots measure anyonic charge in graphene

Anyons are fractionally charged quasiparticles of the quantum Hall effect, and could one day power topological quantum computers. Trapping and measuring anyons remains difficult, but quasiparticle charges have now been measured using a gate-defined antidot in bilayer graphene. For hole-conjugate states, the parity of downstream integer edge modes sets the observed charge.

Research Briefing
25 Sept 2026

A universal speed limit for collective decay in quantum systems

Quantum systems composed of many particles can decay much faster than the sum of their individual decay rates. Now, a universal speed limit of many-body decay has been revealed, providing bounds on applications that rely on collective emission and a potential constraint on the scalability of quantum technologies.

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Review Articles

Review Article
07 Oct 2026

Non-reciprocity in quantum technologies

Non-reciprocity in the quantum regime promises unidirectional transport and enhanced sensing, but traditional approaches hinder device integration. This Review highlights magnet-free routes for engineering non-reciprocity in quantum systems.

Shabir Barzanjeh, André Xuereb ... Peter Rabl

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Articles

Article
25 Sept 2026

Quantum field theory dynamics on a spin–phonon quantum computer

Many physical systems involve bosons, which are resource-intensive to simulate with a qubit-based quantum computer. Now a hybrid approach that combines qubits and bosons has been used to simulate a quantum field theory of fermions and bosons.

Anton T. Than, Saurabh V. Kadam ... Norbert M. Linke

Article
Open Access
25 Sept 2026

Aharonov–Bohm interference in a \({\pmb{\mathbb{Z}}}_{\bf{2}}\) lattice gauge theory on a hybrid qubit–oscillator quantum computer

Lattice gauge theories are difficult to study using classical computational methods. A dynamic quantum simulation of a lattice gauge theory on a two-site loop has now been demonstrated using a hybrid qubit–oscillator trapped-ion quantum computer.

S. Saner, O. Băzăvan ... A. Bermúdez

Article
Open Access
01 Jun 2026

Hong–Ou–Mandel interference of more than ten indistinguishable atoms

Hong–Ou–Mandel interference has been difficult to extend to ensembles of many massive particles. Measurements on up to 12 neutral atoms now exhibit characteristic multiparticle interference pattern with single-atom resolution and negligible loss.

Martin Quensen, Mareike Hetzel ... Carsten Klempt

Article
06 Oct 2026

Topological transitions in orbital-symmetry-controlled chemical reactions

The application of ideas from topological band theory to reaction pathways in molecular systems with strong electronic interactions is challenging. Now, a many-body framework based on Green's functions is introduced to solve this problem.

Ziren Xie, Amir Mirzanejad & Lukas Muechler

Article
Open Access
14 Aug 2026

Quantum Hall antidot as a fractional coulombmeter

A transport technique that allows the measurement of the effective charge of fractional quantum Hall states as they tunnel through a controlled impurity is demonstrated.

Mario Di Luca, Emily Hajigeorgiou ... Mitali Banerjee

Article
24 Aug 2026

Real-space imaging of moiré-confined excitons in twisted bilayer MoS_2

Moiré excitons have been widely observed in twisted two-dimensional semiconductors but have not been directly imaged at room temperature. Now, this is achieved using photocurrent atomic force microscopy.

Laurens J. M. Westenberg, Lumen Eek ... Pantelis Bampoulis

Article
07 Aug 2026

Time-domain identification of distinct mechanisms for competing charge density waves in a rare-earth tritelluride

$ErTe_3$ hosts two charge-density-wave orders and the origin of the weaker one remains unclear. Tracking its recovery after light excitation now points to nucleation and growth as the underlying mechanism.

Yifan Su, B. Q. Lv ... Nuh Gedik

Article
Open Access
31 Aug 2026

Optical control of electrons in a Floquet topological insulator

Driving a solid with light can create a topological insulator, but controlling its electrons has remained elusive. Optical control of electrons in a Floquet topological insulator has now been achieved in light-dressed graphene.

Daniel M. B. Lesko, Tobias Weitz ... Peter Hommelhoff

Article
Open Access
10 Aug 2026

Time-resolved imaging of antiferromagnetic skyrmion interactions

Understanding the time-resolved dynamics of antiferromagnetic skyrmion interactions remains a challenge, limiting control over their collective behaviour. Now their ultrafast dynamics is visualized in real time in thin-film multilayers.

Mona Bhukta, Takaaki Dohi ... Mathias Kläui

Article
27 Aug 2026

Electric-field control of coherent ferron oscillations

Understanding the non-equilibrium dynamics of ferrons—collective excitations of electric polarization—is crucial for device applications. Now electric-field control of coherent ferron oscillations is demonstrated in a layered ferroelectric.

Baolong Zhang, Ruihuan Duan ... Ranjan Singh

Article
Open Access
31 Jul 2026

Quantification of elastic barriers to rearrangement in molecular glasses

Elastic stresses are believed to play a role in the vitrification process in glasses, but measuring them is challenging. Imposing elastic boundary conditions is now shown to provide a way to probe elastic effects within glassy samples.

Peng Luo, Zixuan Lin ... Zahra Fakhraai

Article
11 Aug 2026

Phase coherence and disorder-induced wave propagation in micromotor arrays

Systems of coupled self-propulsive components, both biological and synthetic, display coordinated dynamics. Experiments with three-dimensional printed motors now show that rotary motion can lead to spatiotemporal order as well as disorder-induced wave propagation.

Romane Braun, Alexis Poncet ... Denis Bartolo

Article
14 Apr 2026

Intrinsic phononic dressed states in a nanomechanical system

Exploiting the differences between quantum and classical physics typically requires nonlinear devices. Quantum nonlinear effects have now been demonstrated in a nanomechanical resonator due to strong coupling with an intrinsic two-level defect.

M. Yuksel, M. P. Maksymowych ... M. L. Roukes

Article
Open Access
07 Aug 2026

Large intra-chromosome heterogeneity leads to emergent nonlinear mechanics

Analysis of the mechanical properties of mitotic chromosomes is key for understanding the robustness of chromosomes during cell division. It is now shown that chromosomes are highly mechanically heterogeneous.

Constantijn van der Smagt, Janni Harju ... Erwin J. G. Peterman

Article
18 Aug 2026

Irreversibility and symmetry breaking in the creation and annihilation of defects in active living matter

Creation and annihilation of topological defects are prevalent in active materials. It is now shown that in living systems with nematic order, polar propulsion breaks mirror symmetry during these processes.

A. Be'er, E. D. Neimand ... V. Yashunsky

Article
27 Jul 2026

Topological phase transitions and mixed-state order in a Hubbard quantum simulator

Topological phases can be hard to distinguish with local measurements. Now, a transition between two such phases has been revealed in ultracold erbium atoms, and shown to disappear when two systems are stacked or information about disorder is lost.

Lin Su, Rahul Sahay ... Markus Greiner

Article
12 Aug 2026

Simple and efficient end-to-end quantum thermal and ground state preparation

Preparation of thermal and ground states is needed for a number of quantum algorithms but is generally computationally difficult. Now state preparation algorithms with efficiency guarantees have been developed for an important class of model.

Zhiyan Ding, Yongtao Zhan ... Lin Lin

Article
Open Access
07 Aug 2026

Perfect particle transmission through duality defects

Dualities between different models are an important tool in theoretical many-body physics. Here a constructive recipe is given for topological interfaces between dual models that are transparent to wavepackets but alter their properties.

Atsushi Ueda, Vic Vander Linden ... Frank Verstraete

Article
Open Access
25 Sept 2026

Universal scaling laws for correlated decay of many-body quantum systems

Decoherence and decay of quantum systems arise from interactions with their environment that can be highly complex. Despite this complexity, bounds on the decay rate are found that are asymptotically tight in several important cases.

Wai-Keong Mok, Avishi Poddar ... Ana Asenjo-Garcia

Article
14 Sept 2026

An algorithm to generate two-dimensional critical lattice models using competing anyon condensation

Conformal field theories have a central role in statistical and high-energy theoretical physics. An algorithm to systematically generate critical lattice models described by different conformal field theories has now been identified.

Kaixin Ji, Yu Zhao ... Ling-Yan Hung

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Amendments & Corrections

Publisher Correction
Open Access
23 Sept 2026

Publisher Correction: Optical control of electrons in a Floquet topological insulator

Daniel M. B. Lesko, Tobias Weitz ... Peter Hommelhoff

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Measure for Measure

Measure for Measure
09 Oct 2026

Capture CO_2 concentration

Enhanced concentrations of greenhouse gases in the atmosphere drive climate change. Oksana Tarasova explains how they are measured.

Oksana Tarasova

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