Reviews of Modern Physics

ON THE COVER

Kitaev quantum spin liquids

3 DECEMBER, 2025

Frustration in spin systems can prevent ordering even at $T=0$, creating quantum spin liquids that have been sought since Anderson's pioneering work in 1973 and his influential 1987 paper connecting them to high-temperature superconductivity. Kitaev's solvable spin-1/2 models on a honeycomb lattice brought renewed attention to this field, with Jackeli and Khaliullin later revealing how to engineer Kitaev interactions in real materials. This review highlights theoretical and experimental developments in Kitaev spin liquids, emphasizing leading candidate materials and their broad topological properties such as chiral edge modes. Consequently, it provides essential insights for both experimentalists and theorists working on quantum spin liquid problems.

Yuji Matsuda, Takasada Shibauchi, and Hae-Young Kee
Rev. Mod. Phys. **97**, 045003 (2025)

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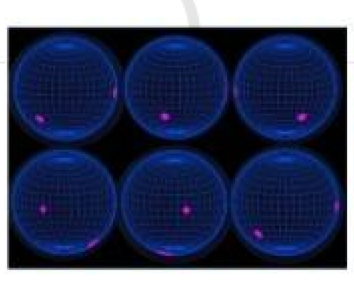

NEW ARTICLE

Neutron stars and the dense matter equation of state

24 DECEMBER, 2025

Neutron stars, the remnants of supernova explosions, are the densest objects in the Universe. A typical neutron star has a mass between one and two solar masses, and a radius of around 12 km. The density at the center of the star is higher than that in atomic nuclei. As a result, the properties of neutron stars provide important information about the behavior of ordinary matter under extreme compression. In recent years, new information about neutron stars has emerged from two sources. The first is the observation of the gravitational-wave signal from the final inspiral of a coalescing binary neutron star. The second is a careful measurement of the x-ray pulse profile of a spinning neutron star. This review discusses these measurements and summarizes how they constrain masses, radii, and central densities. The results are compared to predictions based on calculations of the nuclear equation of state at densities comparable to that in atomic nuclei, which are then extrapolated to higher density. The review ends with an outlook on future observational opportunities.

Katerina Chatziioannou *et al.*
Rev. Mod. Phys. **97**, 045007 (2025)

ANNOUNCEMENT

American Physical Society launches APS Open Science to expand global participation in trusted physics research

3 DECEMBER, 2025

APS Open Science will provide a community-driven platform that broadens recognition for high-quality physics research across all stages of discovery.

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ANNOUNCEMENT

American Physical Society to launch new open access journal on AI and machine learning in scientific research

19 NOVEMBER, 2025

PRX Intelligence will publish high-impact research on artificial intelligence and machine learning that advances the physical sciences.

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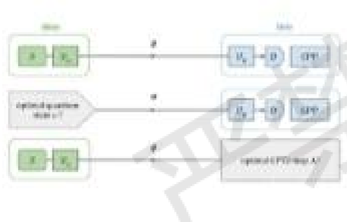
NEWS

Astronomy and Astrophysics in the *Physical Review*

Several free-to-publish and Open Access journals from our portfolio have come together to form the *Astronomy and Astrophysics Topical Group*, dedicated to covering a broad range of topics in astronomy and astrophysics, from nuclear astrophysics to exoplanets and planetary atmospheres.



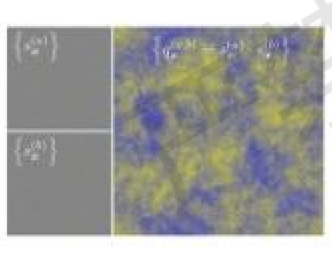
NEW ARTICLE

Quantum cryptography beyond key distribution: Theory and experiment

19 DECEMBER, 2025

Cryptography not only involves the sending of secret messages but also encompasses many protocols and procedures that provide privacy and security in the networked world. Likewise, quantum resources have the potential to enhance cryptography in ways that go beyond the well-known example of quantum key distribution. This review offers a classification of the main crypto primitives that are available quantum mechanically. It explains the security that they offer, including the sometimes significant limitations on their theoretical capabilities. Implementations using current photonic techniques are discussed.

Mathieu Bozzio, Claude Crépeau, Petros Wallden, and Philip Walther
Rev. Mod. Phys. **97**, 045006 (2025)



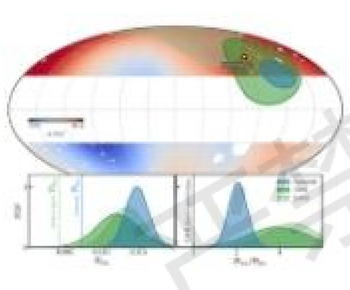
NEW ARTICLE

Spin-glass dynamics: Experiment, theory, and simulation

15 DECEMBER, 2025

This review updates the field of spin glasses with broad application to a large variety of physical systems. In particular, this review tracks the progress of experiment, theory, and large-scale simulations. It highlights the importance of their synergy, from the inception of the field to the present day, and includes future opportunities for research.

E. D. Dahlberg *et al.*
Rev. Mod. Phys. **97**, 045005 (2025)



NEW ARTICLE

Colloquium: The cosmic dipole anomaly

11 DECEMBER, 2025

The cosmological principle, which states that the Universe must be statistically isotropic and homogeneous on large scales, is a foundational principle of the standard model of cosmology, known as lambda cold dark matter (CDM). The validity of this principle can be tested by assessing the compatibility of a dipole anisotropy in the large-scale distribution of matter with the dipole observed in the cosmic microwave background, interpreted in the CDM model as due to our local peculiar motion. This Colloquium describes the methodology for such a test and presents its outcome based on the analysis of recent large catalogs of radio galaxies and quasars, revealing a significant inconsistency between the two dipoles. The authors review these recent findings, as well as potential biases, systematic issues, and alternate interpretations, and discuss how this anomaly could challenge the standard description of our Universe based on the CDM model.

Nathan Secrest *et al.*
Rev. Mod. Phys. **97**, 041001 (2025)

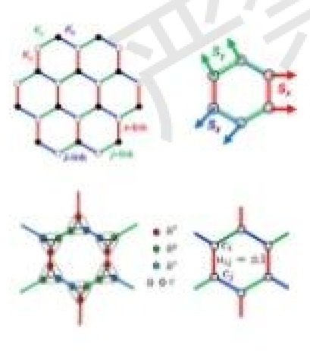
NEW ARTICLE

Astrophysical tests of dark matter self-interactions

8 DECEMBER, 2025

Dark sectors, involving new particles that couple very weakly to the standard model ones, play an important role in current model-building efforts in particle physics, as they allow, for example, for new dark matter production and interaction mechanisms. This review focuses on self-interacting dark matter scenarios, their implications on the dynamics and distribution of dark matter halos in the Universe, and the related astrophysical tests and observations, from galaxies to large-scale structures. It is embedded in the framework of the Novel Probes Project, a forum connecting observers and theorists involved in the study of astrophysical tests of dark-sector interactions.

Susmita Adhikari *et al.*
Rev. Mod. Phys. **97**, 045004 (2025)



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EDITORIAL

Editorial: Coauthor! Coauthor!

21 MAY, 2024

When determining the authorship list for your next paper, be generous yet disciplined.

About Reviews of Modern Physics

Reviews of Modern Physics is the premier APS venue for publishing in-depth reviews of critical or timely topics that give context to current research trends in physics and adjacent fields.

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Vol. 97, Iss. 4 — October - December 2025

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Announcements

New Associate Editor for *Reviews of Modern Physics* - Urbasi Sinha

8 DECEMBER, 2025

APS is delighted to announce the appointment of Urbasi Sinha as an Associate Editor of *Reviews of Modern Physics*.

American Physical Society launches APS Open Science to expand global participation in trusted physics research

3 DECEMBER, 2025

APS Open Science will provide a community-driven platform that broadens recognition for high-quality physics research across all stages of discovery.

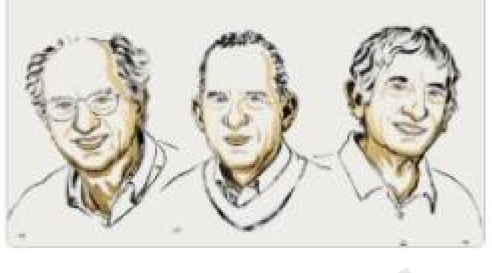
2025 government shutdown: Flexible deadlines

17 OCTOBER, 2025

We recognize that the ongoing U.S. government shutdown is affecting many in the scientific community, including authors and reviewers of the Physical Review journals, by delaying projects, disrupting funding, and creating uncertainty.

American Physical Society congratulates winners of the 2025 Nobel Prize in Physics

7 OCTOBER, 2025



Three APS members have received the prize for experiments with a handheld system that revealed quantum physics in action.

DESI Data Release 2 Publications

6 OCTOBER, 2025

After announcing their new result at the Global Physics Summit in Anaheim, CA, the DESI collaboration submitted their Data Release 2 papers to *Physical Review D*, which are now published.

See the Special Issue here.

Sujit Datta appointed Chief Editor of *Reviews of Modern Physics*

20 AUGUST, 2025

APS is delighted to announce the appointment of Sujit Datta to the position of Chief Editor of *Reviews of Modern Physics*.

Physical Review journals among top research publications in latest Journal Citation Reports

15 JULY, 2025

High rankings demonstrate the impact, reach, and influence of the American Physical Society's journals.

Journal Metrics pages updated with data from the 2024 Journal Citation Reports

25 JUNE, 2025

The 'About' pages for each APS journal have recently been updated with new data from the *2024 Journal Citation Reports* (2025, Clarivate), CiteScore (Scopus Elsevier) and SCImago Journal Rank (SCImago). View the metrics of the entire library on the Journal Metrics page.

The Physics Archive Unlocks 120 Years of Discovery

4 JUNE, 2025

The American Physical Society proudly announces the launch of The Physics Archive, a comprehensive digital library that covers 120 years of groundbreaking research from the world-renowned Physical Review journals.

More Announcements

ISSN 1539-0756 (online), 0034-6861 (print).