Physical Review A

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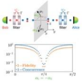
HIGHLIGHTED ARTICLES

EDITORS' SUGGESTION

Generation of polarization-entangled photon pairs from two interacting quantum emitters

Adrián Juan-Delgado, Geza Giedke, Javier Aizpurua, and Ruben Esteban

Phys. Rev. A **112**, 052434 (2025) - Published 19 November, 2025



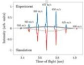
The authors rigorously show that interacting quantum emitters can be used to generate polarization-entangled photon pairs. It is sufficient that the emitters exhibit two-level system behavior and that their transition dipole moments are oriented perpendicular to each other, which could be achieved with, e.g., organic molecules, trapped ions, quantum dots, and diamond-color centers.

EDITORS' SUGGESTION

Intense and controlled beam of S($^1D_2$) atoms

Alexandra Tsoukala, Saskia Bruil, Niek Janssen, Saskia Pieters, and Jolijn Onvlee

Phys. Rev. A **112**, 053113 (2025) - Published 21 November, 2025



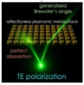
The authors report on the production of a beam of S($^1D_2$) atoms with a well-defined and tunable velocity, narrow velocity spreads, and a high quantum-state purity using a multistage Zeeman decelerator. The results could open the possibility of future studies of reactive and quenching processes involving S($^1D_2$) atoms at tunable and well-defined collision energies.

EDITORS' SUGGESTION

Generalized transverse-electric Brewster effect and perfect absorption with reflectionless plasmonic metasurfaces

Oksana Mankovska, Tymofii Shudra, Artem Hrinchenko, and Oleh Yermakov

Phys. Rev. A **112**, 053516 (2025) - Published 17 November, 2025


generalized Brewster's angle
reflectionless plasmonic metasurface
perfect absorption
TE polarization

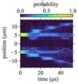
The authors study the transmission, reflection, and absorption of transverse-electric-polarized light by metallic metasurfaces, showing they can facilitate perfect absorption and zero reflection at different tunable critical angles, known as the Brewster angles. This provides a simpler alternative to traditional methods for achieving the transverse-magnetic electric Brewster effect, which typically rely on bulk magnetic media.

EDITORS' SUGGESTION

Probing spin-motion coupling of two Rydberg atoms by a Stern-Gerlach-like experiment

Gabriel Emperauger, Mu Qiao, Guillaume Bornet, Yuki Torii Chew, Romain Martin, Bastien Gély, Lukas Klein, Daniel Barredo, Thierry Lahaye, and Antoine Browaeys

Phys. Rev. A **112**, 053717 (2025) - Published 17 November, 2025



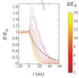
The authors propose and implement a protocol to observe spin-dependent forces in Rydberg atoms by measuring the state-dependent motion of the atoms induced by dipole-dipole interactions. The work potentially paves the way for controlling atomic motion, both for utilizing it as a quantum resource and for mitigating its limiting effects in certain applications.

EDITORS' SUGGESTION LETTER

Temporal dynamics in the Bragg reflection of light by cold atoms: Flash effect and superradiant decay

S. Asselie, J.-M. Nazon, R. Caldani, C. Roux-Spitz, and W. Guerin

Phys. Rev. A **112**, L051701 (2025) - Published 14 November, 2025



The authors study the transient optical response of a Bragg mirror made of cold atoms trapped in a one-dimensional lattice. They find that after the switch-off of the incoming beam, depending on its frequency, the reflected intensity can temporarily increase, or, on the contrary, can undergo a decay much faster than the natural timescale of the response of individual atoms.

LETTERS

Fundamental concepts

LETTER

Quantum thermal machines and the emergence of different thermodynamic functioning regimes from finite coupling to a load

Gauthameshwar S., Noufal Jaseem, and Dario Poletti

Phys. Rev. A **112**, L050201 (2025) - Published 6 November, 2025

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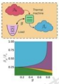

The authors show that the functioning of a thermal machine is not only dependent on temperature differences, but is also critically affected by the magnitude of the coupling between the thermal machine and its load, and on the initial preparation of the load.

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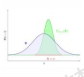
LETTER

Incompatibility of deterministic underlying states with a counterfactual account of Lüders' rule

Alisson Tezzin, Bárbara Amaral, and Jonte R. Hance

Phys. Rev. A **112**, L050202 (2025) - Published 10 November, 2025



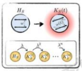
The authors show that the quantum state update rule (Lüder's Rule), when interpreted as the updated state telling us what future measurement results would be, stops the most common forms of the hidden-variable model of quantum mechanics (including ontological models) from modeling incompatible observables. Despite what is often claimed, this indicates that the inability of these models to reproduce quantum predictions for a given scenario may be telling us nothing more than "the scenario involves incompatible observables."

LETTER

Unveiling coherent dynamics in non-Markovian open quantum systems: Exact expression and recursive perturbation expansion

Alessandra Colla, Heinz-Peter Breuer, and Giulio Gasbarri

Phys. Rev. A **112**, L050203 (2025) - Published 26 November, 2025



The authors identify the coherent contribution to non-Markovian open-system dynamics by deriving an explicit formula for the effective Hamiltonian and a recursive perturbation expansion. They demonstrate the approach on spin systems to reveal how environmental correlations affect energy levels.

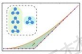
Quantum information science

LETTER

Witnessing nonstabilizerness with Bell inequalities

R. A. Macêdo, P. Andriolo, S. Zamora, D. Poderini, and R. Chaves

Phys. Rev. A **112**, L050401 (2025) - Published 25 November, 2025



This work shows that certain Bell inequalities can act as witnesses of nonstabilizerness, linking two fundamental quantum resources within a device-independent framework.

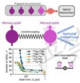
Quantum technologies

LETTER

Fast mixed-species quantum logic gates for trapped-ion quantum networks

Zain Mehdi, Varun D. Vaidya, Isabelle Savill-Brown, Phoebe Grosser, Alexander K. Ratcliffe, Haonan Liu, Simon A. Haine, Joseph J. Hope, and C. Ricardo Viteri

Phys. Rev. A **112**, L050601 (2025) - Published 6 November, 2025



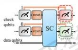
The authors propose the use of ultrafast laser pulses to rapidly transfer quantum information between noisy network qubits and stable memory qubits in trapped-ion quantum networks. The authors demonstrate that high-fidelity and high-speed quantum logic operations are achievable between a broad range of mixed-species ion pairs, which allows multiple specialized qubits to be employed in quantum networks of trapped-ion processors.

LETTER

Feedforward suppression of readout-induced faults in quantum error correction

Liran Shirizly, Dekel Meirom, Malcolm Carroll, and Haggai Landa

Phys. Rev. A **112**, L050602 (2025) - Published 12 November, 2025



The authors propose reducing readout-induced faults in error correction by using an adaptive readout sequence conditioned on each check qubit's measurement result from the previous cycle. Simulations of Pauli errors with a low-density parity check code show improvements manifesting as a lower logical error rate and faster decoding.

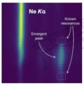
Light-induced processes in atomic-scale systems

LETTER

Emergence of pseudoresonance in high-intensity resonant inelastic x-ray scattering

Sang-Kil Son (손상길) *et al.*

Phys. Rev. A **112**, L051101 (2025) - Published 7 November, 2025



The authors demonstrate that the one-to-one correspondence between individual peak positions and individual resonant transitions breaks down when pushing x-ray spectroscopy into the nonlinear regime by using x-ray free-electron lasers (XFELs). The results show that resonance-like peaks in XFEL-based absorption spectra do not always represent actual resonances, a feature that is general whenever two or more resonances with broad resonance profiles are involved.

LETTER

Enhanced quantum radiation with flying-focus laser pulses

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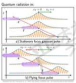
Martin S. Formanek, John P. Palastro, Dillon Ramsey, and Antonino Di Piazza

Phys. Rev. A **112**, L051102 (2025) - Published 13 November, 2025



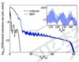
This work demonstrates that a space-time-structured laser pulse, such as a flying focus, can enhance observable signatures of strong-field quantum electrodynamics for currently available experimental parameters. Specifically, the energy radiated and photon yield can be significantly increased by colliding an ultrarelativistic electron with a flying-focus pulse instead of a typical stationary-focus pulse with the same energy.

LETTER

Intensity-dependent enhancements in strong-field ionization by quantum light

D. Habibović and D. B. Milošević

Phys. Rev. A **112**, L051103 (2025) - Published 14 November, 2025



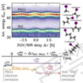
By modeling intense quantum bright-squeezed-vacuum light as a superposition of coherent states, this work reveals a broadened photoelectron energy spectrum and distinct intensity-dependent enhancements arising from quantum interference in high-order above-threshold ionization.

LETTER

Photoemission chronoscopy of the iodoalkanes

Christian A. Schröder, Maximilian Pollanka, Pascal Freisinger, Matthias Ostner, Maximilian Forster, Sven-Joachim Paul, and Reinhard Kienberger

Phys. Rev. A **112**, L051104 (2025) - Published 18 November, 2025



How do core-level photoemission time delays in molecules vary as a function of their size? The authors address this question by systematically measuring the photoemission time of the I 4*d* core level in small iodoalkanes from iodomethane to 2-iodobutane, varying the excitation energy across Iodine's giant resonance.

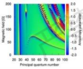
Ultracold systems and matter waves

LETTER

Proposal for realizing Heisenberg-type quantum-spin models in Rydberg-atom quantum simulators

Masaya Kunimi and Takafumi Tomita

Phys. Rev. A **112**, L051301 (2025) - Published 5 November, 2025



The authors describe a way to use a static magnetic field to tune interactions between Rydberg atoms, allowing Heisenberg-type spin models to be realized in programmable quantum simulators. Examples include the spin-1/2 Majumdar-Ghosh model and the spin-1 Heisenberg chain.

LETTER

Self-induced Josephson oscillations and self-trapping in a supersolid dipolar quantum gas

Beatrice Donelli, Nicolò Antolini, Giulio Biagioni, Marco Fattori, Andrea Fioretti, Carlo Gabbanini, Massimo Inguscio, Luca Tanzi, Giovanni Modugno, Augusto Smerzi, and Luca Pezzè

Phys. Rev. A **112**, L051302 (2025) - Published 5 November, 2025

self-induced Josephson oscillations
self-induced self-trapped oscillations

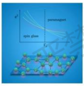
The authors show that self-induced Josephson oscillations and macroscopic self-trapping can occur in elongated dipolar supersolids without any external barrier or weak link. This effect is captured by a general model that incorporates trap inhomogeneities.

LETTER

Spin-glass quantum phase transition in amorphous arrays of Rydberg atoms

L. Brodoloni, J. Vovrosh, S. Julià-Farré, A. Dauphin, and S. Pilati

Phys. Rev. A **112**, L051303 (2025) - Published 13 November, 2025



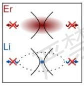
The authors explore amorphous arrays of Rydberg atoms using a neural quantum Monte Carlo approach. The authors uncover a quantum spin-glass phase transition driven by the interplay between geometric frustration and lattice disorder.

LETTER

Dissipationless tune-out trapping for a lanthanide–alkali-metal quantum gas mixture

Alexandre De Martino, Florian Kiesel, Jonas Auch, Kirill Karpov, and Christian Gross

Phys. Rev. A **112**, L051304 (2025) - Published 14 November, 2025



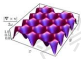
A central advantage of dual-species quantum gas experiments is the possibility for independent optical control utilizing tuneout wavelengths. The key innovation of this work is the reduction of dissipation from light scattering, so far a limiting aspect in tuneout trapping, to negligible levels.

LETTER

Unconventional vortex lattice and topological defects in rigidly rotating multicomponent superfluids

Roy Rabaglia, Ryan L. Barnett, and Ari M. Turner

Phys. Rev. A **112**, L051305 (2025) - Published 17 November, 2025



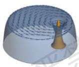
The authors study the connection between fluid flow and magnetic texture in rigidly rotating multicomponent superfluids, approaching the problem from the perspective of large spin. They find that topological defects in the magnetic texture, whose existence is predicted by the Riemann-Hurwitz formula, lead to a lattice of "unvortices" in the flow field, in which the fluid's otherwise solid-body rotation vanishes.

LETTER

Dynamical signature of vortex mass in Fermi superfluids

Andrea Richaud, Matteo Caldara, Massimo Capone, Pietro Massignan, and Gabriel Wlazłowski

Phys. Rev. A **112**, L051306 (2025) - Published 21 November, 2025



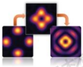
The authors use a microscopic approach to study the dynamics of a quantized vortex in a Fermi superfluid. By tracking the vortex and measuring the frequency of its cyclotron oscillations, they determine the intrinsic mass of the vortex.

LETTER

Superresolution optical trapping of multiple cold atoms

Kelvin Lim, Vincent Mancois, Haijun Wu, Yijie Shen, and David Wilkowski

Phys. Rev. A **112**, L051307 (2025) - Published 26 November, 2025



Most tweezer array designs focus on generating a large number of independent sites with no connectivity. Departing from this conventional approach, the authors demonstrate how to restore controllable connectivity between a few sites by adjusting the phase of individual tweezers. They further observe thermal hopping of atoms within a super-resolved tweezer array under periodic boundary conditions.

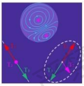
Photonics, nonlinear optics, and optomechanics

LETTER

Topological optical achirality

Chunchao Wen, Zhichun Qi, Jianfa Zhang, Chaofan Zhang, Shiqiao Qin, Zhihong Zhu, and Wei Liu

Phys. Rev. A **112**, L051501 (2025) - Published 10 November, 2025



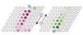
Through the Poincaré–Hopf theorem and Lorentz reciprocity, the authors prove that for arbitrary reciprocal single-mode structures, there must exist incident directions for which they are optically achiral.

LETTER

Dynamics of transport by helical edge states

Luis Alberto Razo López, Pierre Wulles, Geoffroy J. Aubry, Sergey E. Skipetrov, and Fabrice Mortessagne

Phys. Rev. A **112**, L051502 (2025) - Published 12 November, 2025



In a microwave analog of a quantum spin Hall system, the authors demonstrate how helical edge states transport electromagnetic energy along topological boundaries. This propagation is locked to pseudospin and remains unaffected by structural imperfections.

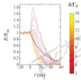
Quantum optics

EDITORS' SUGGESTION LETTER

Temporal dynamics in the Bragg reflection of light by cold atoms: Flash effect and superradiant decay

S. Asselie, J.-M. Nazon, R. Caldani, C. Roux-Spitz, and W. Guerin

Phys. Rev. A **112**, L051701 (2025) - Published 14 November, 2025



The authors study the transient optical response of a Bragg mirror made of cold atoms trapped in a one-dimensional lattice. They find that after the switch-off of the incoming beam, depending on its frequency, the reflected intensity can temporarily increase, or, on the contrary, can undergo a decay much faster than the natural timescale of the response of individual atoms.

ARTICLES

Fundamental concepts

High-entanglement regimes in the Weisskopf-Wigner theory for spontaneous decay

J. C. C. Capella, Alejandro Fonseca, Pablo L. Saldanha, and D. Felinto

Phys. Rev. A **112**, 052201 (2025) - Published 3 November, 2025

Quantum-imaginarity-based quantum speed limit

Dong-Ping Xuan, Zhong-Xi Shen, Wen Zhou, Shao-Ming Fei, and Zhi-Xi Wang

Phys. Rev. A **112**, 052202 (2025) - Published 3 November, 2025

Characterization of P-divisibility in two-level open quantum systems

G. Théret, C. Lombard-Latune, and D. Sugny

Phys. Rev. A **112**, 052203 (2025) - Published 3 November, 2025

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Family of exact and inexact quantum speed limits for completely positive and trace-preserving dynamics

Abhay Srivastav, Vivek Pandey, Brij Mohan, and Arun Kumar Pati

Phys. Rev. A **112**, 052204 (2025) - Published 3 November, 2025

Attainable quantum speed limit for N-dimensional quantum systems

Zi-yi Mai and Chang-shui Yu

Phys. Rev. A **112**, 052205 (2025) - Published 4 November, 2025

Sequential quantum maximum-confidence discrimination

Hanwool Lee, Kieran Flatt, and Joonwoo Bae

Phys. Rev. A **112**, 052206 (2025) - Published 6 November, 2025

Fractional Thouless pumping of solitons: A unique manifestation of bulk-edge correspondence of nonlinear eigenvalue problems

Chenxi Bai and Zhaoxin Liang

Phys. Rev. A **112**, 052207 (2025) - Published 7 November, 2025

Sufficiency of the counterfactual account of Lüders' rule to rule out ontological models of quantum mechanics

Alisson Tezzin, Bárbara Amaral, and Jonte R. Hance

Phys. Rev. A **112**, 052208 (2025) - Published 10 November, 2025

Bulk-boundary correspondence in non-Hermitian class-$\mathrm{D}^\dagger$ topological systems

Kai-Xin Hu, Chen Luo, Jie Zhang, Shutian Liu, Wen-Xue Cui, Ji Cao, Shou Zhang, and Hong-Fu Wang

Phys. Rev. A **112**, 052209 (2025) - Published 10 November, 2025

Symmetry properties of quantum dynamical entropy

Eric D. Schultz, Keiichiro Furuya, and Laimei Nie

Phys. Rev. A **112**, 052210 (2025) - Published 12 November, 2025

Observing the exponential growth of the eigenmodes in the absence of coalescence for a non-Hermitian circuit with an unavoidable inductor dissipation

Jiaming Zhang, Wenxuan Song, Hanhao Li, Zhiye Kuang, Zhihua Xiong, Longwen Zhou, Jie Liu, and Wen-Lei Zhao

Phys. Rev. A **112**, 052211 (2025) - Published 13 November, 2025

Context-dependent time-energy uncertainty relations from projective quantum measurements

Mathieu Beau

Phys. Rev. A **112**, 052212 (2025) - Published 13 November, 2025

Qubit thermodynamics: Entropy production from nonadiabatic driving

Pavel Zhelnin, Lucas Johns, and Carlos A. Argüelles

Phys. Rev. A **112**, 052213 (2025) - Published 13 November, 2025

Ergotropy transport in a one-dimensional spin chain

Dara Murphy, Anthony Kiely, Irene D'Amico, and Steve Campbell

Phys. Rev. A **112**, 052214 (2025) - Published 14 November, 2025

Enhanced performance across Otto, Carnot, and Stirling cycles revealed by flat-band thermodynamics

Hadi Mohammed Soufy and Colin Benjamin

Phys. Rev. A **112**, 052215 (2025) - Published 14 November, 2025

Chaos and quantum regimes in n-photon-driven dissipative bosonic chains

Leo Kruglikov, Filippo Ferrari, and Vincenzo Savona

Phys. Rev. A **112**, 052216 (2025) - Published 17 November, 2025

Torsion-driven nonlinearity in spinless quantum mechanics

Tomoi Koide and Armin van de Venn

Phys. Rev. A **112**, 052217 (2025) - Published 18 November, 2025

Dynamics of classical analogs of bosons, fermions, and beyond

Varsha Subramanyan, T. H. Hansson, and Smitha Vishveshwara

Phys. Rev. A **112**, 052218 (2025) - Published 19 November, 2025

Grand unification of all discrete Wigner functions on $d \times d$ phase space

Lucky K. Antonopoulos, Dominic G. Lewis, Jack Davis, Nicholas Funai, and Nicolas C. Menicucci

Phys. Rev. A **112**, 052219 (2025) - Published 20 November, 2025

Ergotropy-based quantum thermodynamics
J. M. Z. Choquehuanca, P. A. C. Obando, M. S. Sarandy, and F. M. de Paula
Phys. Rev. A **112**, 052220 (2025) - Published 21 November, 2025

Quantum signatures and semiclassical limitations in the transmission of Fock states
D. J. Nader
Phys. Rev. A **112**, 052221 (2025) - Published 24 November, 2025

Recursive perturbation approach to time-convolutionless master equations: Explicit construction of generalized Lindblad generators for arbitrary open systems
Alessandra Colla, Heinz-Peter Breuer, and Giulio Gasbarri
Phys. Rev. A **112**, 052222 (2025) - Published 24 November, 2025

Nonorientable exceptional points in the Klein Brillouin zone
Jung-Wan Ryu, Jae-Ho Han, Moon Jip Park, Hee Chul Park, and Chang-Hwan Yi
Phys. Rev. A **112**, 052223 (2025) - Published 24 November, 2025

Toward a global search for new physics with isotope shifts
Elina Fuchs, Fiona Kirk, Agnese Mariotti, Jan Richter, and Matteo Robbiati
Phys. Rev. A **112**, 052224 (2025) - Published 25 November, 2025

Conclusive local state marking: More nonlocality with no entanglement
Samrat Sen
Phys. Rev. A **112**, 052225 (2025) - Published 26 November, 2025

Quantum information science

Local inaccessibility of random classical information and their implications in the change-point problem
Snehasish Roy Chowdhury, Subhendu B. Ghosh, Tathagata Gupta, Anandamay Das Bhowmik, Sutapa Saha, Some Sankar Bhattacharya, and Tamal Guha
Phys. Rev. A **112**, 052401 (2025) - Published 3 November, 2025

Exact quantification of bipartite entanglement in unresolvable spin ensembles
Tzu-Wei Kuo and Hoi-Kwan Lau
Phys. Rev. A **112**, 052402 (2025) - Published 3 November, 2025

Average correlation as a resource of quantum teleportation
Youneng Guo, Xiangjun Chen, Huping Peng, and Qinglong Tian
Phys. Rev. A **112**, 052403 (2025) - Published 3 November, 2025

Non-Markovian speedup dynamics via quantum cyclic n-switch
Zhen-Dong Wei, Wei Han, Ying-Jie Zhang, Wei-Bin Yan, Zhong-Xiao Man, Yun-Jie Xia, and Qing-Yu Cai
Phys. Rev. A **112**, 052404 (2025) - Published 3 November, 2025

Non-Markovian noise limits for sustaining entanglement in multiparty quantum states
Suchetana Goswami and Ujjwal Sen
Phys. Rev. A **112**, 052405 (2025) - Published 3 November, 2025

Entanglement-measure vectors with generalized entanglement axioms
Xue Yang, Yan-Han Yang, Xin-Zhu Liu, Jun-Li Jiang, Liu Liu, Zhihao Ma, Shao-Ming Fei, and Ming-Xing Luo
Phys. Rev. A **112**, 052406 (2025) - Published 3 November, 2025

Measurement reduction for expectation values via fine-grained commutativity
Ben DalFavero, Rahul Sarkar, Jeremiah Rowland, Daan Camps, Nicolas P. D. Sawaya, and Ryan LaRose
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Stabilizer-accelerated quantum many-body ground-state estimation
Caroline E. P. Robin
Phys. Rev. A **112**, 052408 (2025) - Published 3 November, 2025

General-purpose quantum architecture search based on deep reinforcement learning
Xiao-Yu Bi, Yi-Ming Yu, Ye-Hong Chen, and Zhi-Rong Zhong
Phys. Rev. A **112**, 052409 (2025) - Published 4 November, 2025

Quantum dual extended Hamming code immune to collective coherent errors
En-Jui Chang
Phys. Rev. A **112**, 052410 (2025) - Published 5 November, 2025

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Features of preparable entangled states in Gaussian quantum networks

Shuanping Du and Zhaofang Bai

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Leveraging magic resources for quantum channel capacity enhancement under stabilizer convolution

Wenlong Sun and Yuanfeng Jin

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Entanglement source preparation via three-photon quantum scissors enhanced by realistic conditions

Liangjun Zhou, Yinxuan Cai, Zekun Zhao, Cunjin Liu, Teng Zhao, and Liyun Hu

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Estimating decoding graphs and hypergraphs of memory quantum error-correction experiments

Evangelia Takou and Kenneth R. Brown

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Self-testing measurements in networks from star shaped to tree shaped based on genuine network nonlocality

Pu Jia, Fenzhuo Guo, Haifeng Dong, Sujuan Qin, and Fei Gao

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Evolution of different orders of coherence of a three-qubit system and their protection via dynamical decoupling on an NMR quantum processor

Akanksha Gautam, Kavita Dorai, and Arvind

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Quantum low-density parity-check codes for erasure-biased atomic quantum processors

Laura Pecorari and Guido Pupillo

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Resource-efficient self-tallying quantum anonymous voting

Yu-Guang Yang, Shi Qiu, Yue-Chao Wang, Guang-Bao Xu, and Dong-Huan Jiang

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Bounds on concatenated entanglement-assisted quantum error-correcting codes

Nihar Ranjan Dash, Sanjoy Dutta, R. Srikanth, and Subhashish Banerjee

Phys. Rev. A **112**, 052419 (2025) - Published 10 November, 2025

Entropic uncertainty relations for mutually unbiased equiangular tight frames assigned to quantum t-designs

Fan Huang and Mingqiang Bai

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Natural gradient and parameter estimation for quantum Boltzmann machines

Dhrumil Patel and Mark M. Wilde

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Quantum community detection via deterministic elimination

Chukwudubem Umeano, Stefano Scali, and Oleksandr Kyriienko

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Characterizing stabilizer states and symmetric informationally complete positive-operator-valued-measure fiducial states via uncertainty

Shuangshuang Fu, Lingxuan Feng, and Yue Zhang

Phys. Rev. A **112**, 052423 (2025) - Published 12 November, 2025

Noisy dynamics of Gaussian entanglement: A transient bound entangled phase before separability

Gurvir Singh, Saptarshi Roy, and Arvind

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Exact simulation of realistic Gottesman-Kitaev-Preskill cluster states

Milica Banić, Valerio Crescimanna, J. Eli Bourassa, Carlos González-Arciniegas, Rafael N. Alexander, and Khabat Heshami

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Bargmann-invariant framework for local unitary equivalence and entanglement

Lin Zhang, Bing Xie, and Yuanhong Tao

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Quantum Fisher information and nonlocal operators in one-dimensional quantum chains

Chen Wu, Shu Qu, Bin Guo, and Zhao-Yu Sun

Phys. Rev. A **112**, 052427 (2025) - Published 13 November, 2025

Optimal finite-dimensional probe states for quantum phase estimation

Jin-Feng Qin, Yuqian Xu, and Jing Liu

Phys. Rev. A **112**, 052428 (2025) - Published 14 November, 2025

Transcribing quantum channels into quantum states

Jorge Escandón-Monardes, Daniel Uzcátegui-Contreras, Marco Rivera-Tapia, Marcin Pawłowski, Łukasz Rudnicki, Aldo Delgado, and Stephen P. Walborn

Phys. Rev. A **112**, 052429 (2025) - Published 14 November, 2025

Risk-minimizing states for the quantum-phase-estimation algorithm

Joseph G. Smith, Crispin H. W. Barnes, and David R. M. Arvidsson-Shukur

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Incorporating high-accuracy, finite-volume shock stabilization methods into a quantum algorithm for nonlinear partial differential equations

Ryan Vogt, Harold Berjamin, Hunter Rouillard, Edward Raff, Priyanka Ranade, Torstein Collett, Roberto D'Angelo-Cosme, James Holt, and Frank Gaitan

Phys. Rev. A **112**, 052431 (2025) - Published 17 November, 2025

Cyclicity of interaction-frame transformations

Michael C. D. Tayler and Mohamed Sabba

Phys. Rev. A **112**, 052432 (2025) - Published 18 November, 2025

Ab initio polaritonic chemistry on diverse quantum computing platforms: Ansatz circuit design for qubit, qudit, and hybrid qubit-qumode architectures

Even Chiari, Wafa Makhlouf, Lucie Pepe, Emiel Koridon, Johanna Klein, Bruno Senjean, Benjamin Lasorne, and Saad Yalouz

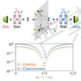
Phys. Rev. A **112**, 052433 (2025) - Published 18 November, 2025

EDITORS' SUGGESTION

Generation of polarization-entangled photon pairs from two interacting quantum emitters

Adrián Juan-Delgado, Geza Giedke, Javier Aizpurua, and Ruben Esteban

Phys. Rev. A **112**, 052434 (2025) - Published 19 November, 2025



The authors rigorously show that interacting quantum emitters can be used to generate polarization-entangled photon pairs. It is sufficient that the emitters exhibit two-level system behavior and that their transition dipole moments are oriented perpendicular to each other, which could be achieved with, e.g., organic molecules, trapped ions, quantum dots, and diamond-color centers.

Toward superpolynomial quantum speedup of equivariant quantum algorithms with $\mathrm{SU}(d)$ symmetry

Han Zheng, Zimu Li, Sergii Strelchuk, Risi Kondor, and Junyu Liu

Phys. Rev. A **112**, 052435 (2025) - Published 19 November, 2025

Rigorous maximum-likelihood estimation for quantum states

K. Aditi and Stephen Becker

Phys. Rev. A **112**, 052436 (2025) - Published 19 November, 2025

Distillation of high-dimensional hyperentangled photons

Dan-Yang Chen, Ming Yang, and Yuanqin Yu

Phys. Rev. A **112**, 052437 (2025) - Published 19 November, 2025

Data-driven quantum dynamical embedding method for long-term prediction on near-term quantum computers

Tai-Ping Sun, Zhao-Yun Chen, Cheng Xue, Huan-Yu Liu, Xi-Ning Zhuang, Yun-Jie Wang, Shi-Xin Ma, Hai-Feng Zhang, Yu-Chun Wu, and Guo-Ping Guo

Phys. Rev. A **112**, 052438 (2025) - Published 19 November, 2025

High-dimensional quantum XYZ product codes for biased noise

Zhipeng Liang, Zhengzhong Yi, Fusheng Yang, Jiahan Chen, Zicheng Wang, and Xuan Wang

Phys. Rev. A **112**, 052439 (2025) - Published 19 November, 2025

Heralded deterministic Knill-Laflamme-Milburn entanglement generation for solid-state emitters via waveguide-assisted photon scattering

Fang-Fang Du, Xin-Shan Du, Zhuo-Ya Bai, and Qiu-Lin Tan

Phys. Rev. A **112**, 052440 (2025) - Published 20 November, 2025

Quantum memory based on concatenating surface codes and quantum Hamming codes

Menglong Fang and Daiqin Su

Phys. Rev. A **112**, 052441 (2025) - Published 20 November, 2025

Quantum block Krylov subspace projector algorithm for computing low-lying eigenenergies

Maria Gabriela Jordão Oliveira and Nina Glaser

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Transfer of quantum-enhanced information through a many-body system

Piotr Wysocki, Marcin Płodzień, and Jan Chwedeńczuk

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Quantum fidelity estimation in the resource theory of nonstabilizerness

Zhiping Liu, Kun Wang, and Xin Wang

Phys. Rev. A **112**, 052444 (2025) - Published 20 November, 2025

Cooperative quantum interface for noise mitigation in quantum networks

Yan-Lei Zhang, Ming Li, Xin-Biao Xu, Chun-Hua Dong, Guang-Can Guo, Ze-Liang Xiang, Chang-Ling Zou, and Xu-Bo Zou

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Auxiliary-assisted energy distillation from quantum batteries

Paranjoy Chaki, Aparajita Bhattacharyya, Kornikar Sen, and Ujjwal Sen

Phys. Rev. A **112**, 052446 (2025) - Published 21 November, 2025

Efficient detection of localization transitions using predictability

Tiago Pernambuco, Jonas Maziero, and Rafael Chaves

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Bayesian inference of general noise-model parameters from the syndrome statistics of surface codes

Takumi Kobori and Synge Todo

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Simultaneous control of populations and coherence phase of open two-level quantum systems with a single pulse

Gustavo Fernandes da Costa and Emanuel Fernandes de Lima

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Exact quantum capacity of decohering channels in arbitrary dimensions

Shayan Roofeh and Vahid Karimipour

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Nonunitary enhanced transfer efficiency in quantum walk search on complex networks

Ugo Nzongani, Andrea Simonetto, and Giuseppe Di Molfetta

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Variational quantum algorithm for entanglement quantification

Lucas Friedrich, Marcos L. W. Basso, Alberto B. P. Junior, Joab M. Varela, Leandro Morais, Rafael Chaves, and Jonas Maziero

Phys. Rev. A **112**, 052452 (2025) - Published 25 November, 2025

Adaptive quantum optimization algorithms for programmable atom-cavity systems

Yuchen Luo, Xiaopeng Li, and Jian Lin

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Quantum Fisher information from tensor-network integration of the Lyapunov equation

Gabriela Wójtowicz, Susana F. Huelga, Marek M. Rams, and Martin B. Plenio

Phys. Rev. A **112**, 052454 (2025) - Published 26 November, 2025

Graph-theoretic approach for self-testing of multipartite Mermin-Ardehali-Belinskiĭ-Klyshko inequalities

Daipengwei Bao, Zhiwei Zhao, Yonghong Zhou, Qingshan Xu, Rui Huang, and Xiaoqing Tan

Phys. Rev. A **112**, 052455 (2025) - Published 26 November, 2025

Quantum technologies

Quantum entanglement response to pulsed gate modulation

E. M. Fernandes, L. Sanz, and F. M. Souza

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Enhancing distillability of secret keys with entanglement distillation and classical advantage distillation

Shin Sun, Kenneth Goodenough, Daniel Bhatti, Koji Azuma, and David Elkouss

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Monte Carlo approach for finding optimally controlled quantum gates with differential geometry

Adonai H. da Silva, Leonardo K. Castelano, and Reginaldo de J. Napolitano

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Achieving optimal multiparameter quantum estimation in optomechanics

A. Naimy, A. Slaoui, A. Lakhfif, H. El Hadfi, and R. Ahl Laamara

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Superresolving collective quantum measurements

J. O. de Almeida, M. Lewenstein, and M. Skotiniotis

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Controlled-$\mathcal{Z}$ gate fidelity in neutral-atom arrays with finite blockade and near-degenerate Rydberg pair states

Diksha Thapliyal, Ishitwa Kumar Das, and Ajay Wasan

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Detector noise in continuous-variable quantum key distribution

Shihong Pan, Dimitri Monokandylos, and Bing Qi

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Application of optimal control to the time-resolution protocol for quantum sensing

Chungwei Lin, Qi Ding, and Yanting Ma

Phys. Rev. A **112**, 052608 (2025) - Published 7 November, 2025

Memory effects in a dynamical decoupling process

S. C. Hou, X. Y. Zhang, Si-wen Li, and X. X. Yi

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End-to-end entanglement of quantum network paths with multiparameter states

Md Sohel Mondal, Aniket Zambare, and Siddhartha Santra

Phys. Rev. A **112**, 052610 (2025) - Published 7 November, 2025

Full-parameter-space quantum simulation of high-fidelity $\mathcal{PT}$-symmetric dynamics in a trapped ion

Linyi Hu, Chunwang Wu, Hongyang Wang, Yi Xie, Jie Zhang, Chunyang Luan, Xiaoming Peng, Yanyi Wang, Ting Chen, Baoquan Ou, Pingxing Chen, and Wei Wu

Phys. Rev. A **112**, 052611 (2025) - Published 12 November, 2025

Sensing high-frequency ac fields via a two-qubit sensor

Rizwan Abbas, Ali Raza Mirza, and Adam Zaman Chaudhry

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Entanglement-enhanced Neyman-Pearson target detection

William Ward, Abdulkarim Hariri, and Zheshen Zhang

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Universal quantum control over Majorana zero modes

Zhu-yao Jin and Jun Jing

Phys. Rev. A **112**, 052614 (2025) - Published 17 November, 2025

Preparing spin-squeezed states in Rydberg atom arrays via quantum optimal control

Edison S. Carrera, Harold Erbin, and Grégoire Misguich

Phys. Rev. A **112**, 052615 (2025) - Published 20 November, 2025

Continuous-variable quantum secret sharing based on constellation shaping

Qin Liao, Junyue Yang, Yiyu Mao, and Xiquan Fu

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Globalized nonlinear critical quantum metrology using the two-photon Rabi-Stark model

Zu-Jian Ying

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Effective reflection mode measurement for hanger-coupled microwave resonators

John R. Pitten, Nicholas Materise, Wei-Ren Syong, Jorge Ramirez, Douglas Bennett, and Corey Rae H. McRae

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Atomic and molecular structure and dynamics; high-precision experiments

Lifetimes of bound excited states of the lanthanum negative ion and implications for laser cooling: Experiment and theory

C. W. Walter, F. E. Vassallo, J. Karls, D. Leimbach, D. Hanstorp, J. E. Navarro Navarrete, O. H. Lundgren, M. K. Kristiansson, M. Björkhage, R. D. Thomas, H. Zettergren, H. T. Schmidt, C. Cheung, M. S. Safronova, and N. D. Gibson

Phys. Rev. A **112**, 052801 (2025) - Published 3 November, 2025

Variational calculation of the hyperfine Stark effect in atomic $^{87}\mathrm{Rb}$, $^{133}\mathrm{Cs}$, and $^{169}\mathrm{Tm}$

Timo Fleig

Phys. Rev. A **112**, 052802 (2025) - Published 3 November, 2025

$\mathrm{CaF}+\mathrm{CaF}$ interactions in the ground and excited electronic states: Implications for collisional losses

Dibyendu Sardar, Marcin Gronowski, Michał Tomza, and John L. Bohn

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Relativistic effects on the ground state of positronic lithium

D.-X. Zhao, K. Hu, M.-S. Wu, J.-Y. Zhang, K.-D. Wang, L.-M. Wang, and Z.-C. Yan

Phys. Rev. A **112**, 052804 (2025) - Published 3 November, 2025

Ionization potential and electron affinity of superheavy element 119: Relativistic high-order coupled-cluster study with QED corrections

A. R. Saetgaraev, L. V. Skripnikov, I. I. Tupitsyn, D. P. Usov, A. V. Oleynichenko, I. M. Savelyev, N. K. Dulaev, and V. M. Shabaev

Phys. Rev. A **112**, 052805 (2025) - Published 4 November, 2025

Electron capture in low-energy collisions of Sn^{3+} ions with H_2 and D_2

K. Bijlsma, E. de Wit, J. L. Pascual, A. Kleinsmit, E. Lalkens, L. Assink, M. Salverda, L. Méndez, O. O. Versolato, I. Rabadán, and R. Hoekstra

Phys. Rev. A **112**, 052806 (2025) - Published 5 November, 2025

Multipole decomposition of the thermal one-loop self-energy correction for a bound atomic electron

J. J. Lopez-Rodriguez, A. Bobylev, P. Kvasov, T. Zalialiutdinov, and D. Solovyev

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Antiprotonic atoms with nonperturbative inclusion of vacuum polarization and finite nuclear mass

Vojtěch Patkóš and Krzysztof Pachucki

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Lightning spectra of collisionally excited N II ions: Role of the ion alignment

D. Wang, Y. Li, T. Y. Wang, S. Fritzsche, and Z. W. Wu

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Thorium in hypersonic gas jets: Ionization potentials of Th and Th^{+}

A. Claessens, F. Ivandikov, M. Brasseur, A. Dragoun, Ch. E. Düllmann, R. Ferrer, Yu. Kudryavtsev, P. Palmeri, P. Quinet, S. Raeder, D. Renisch, P. Van den Bergh, and P. Van Duppen

Phys. Rev. A **112**, 052810 (2025) - Published 10 November, 2025

Emergent synchronization mode in coupled Rydberg atomic chains

Weilun Jiang

Phys. Rev. A **112**, 052811 (2025) - Published 12 November, 2025

Reversing adiabatic state preparation in few-level quantum systems

Leonardo Romanato, N. Eshaqi-Sani, Luca Lepori, Teodora Kirova, Ennio Arimondo, and Sandro Wimberger

Phys. Rev. A **112**, 052812 (2025) - Published 12 November, 2025

Precision calculation of the bound-electron g factor in molecular hydrogen ions

Ossama Kullie, Hugo D. Nogueira, and Jean-Philippe Karr

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Postselection effect in the spectroscopy of the helium $2\,^3S-2\,^3P$ transition

Jia-Dong Tang (唐家栋), Jin-Lu Wen (温金录), Jun-Feng Dong (董俊峰), Yu R. Sun (孙羽), Ya-Nan Lv (吕亚男), and Shui-Ming Hu (胡水明)

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Calculation of spin-polarized muonium-muonium and spin-polarized hydrogen-hydrogen scattering

M.-S. Wu, Y. Zhang, J.-Y. Zhang, K. Varga, and Z.-C. Yan

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Differential ionization cross sections of ethanol by electron impact: Experiment and theoretical analysis

M. Dinger and W. Y. Baek

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Three-body boundary-corrected first-Born eikonal-final-state and eikonal-initial-state methods for single-electron capture in fast ion-atom collisions

Miloš Milenković, Nenad Milojević, Ivan Mančev, and Danilo Delibašić

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Direct structural retrieval from gas-phase ultrafast diffraction data using a genetic algorithm

Cuong Le, Yanwei Xiong, and Martin Centurion

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Dissociative electron recombination and rotational cooling of the deuterated triatomic hydrogen ions H_2D^+ and D_2H^+

A. Znotins, A. Faure, C. H. Greene, M. Grieser, F. Grussie, L. W. Isberner, Á. Kálosi, V. Kokoouline, D. Müll, D. Paul, M. Pezzella, D. W. Savin, S. Schippers, J. Tennyson, A. Wolf, O. Novotný, and H. Kreckel

Phys. Rev. A **112**, 052819 (2025) - Published 17 November, 2025

Generalized independent-atom-model approach for net ionization of molecules by multiply-charged-heavy-ion impact

Hans Jürgen Lüdde, Marko Horbatsch, and Tom Kirchner

Phys. Rev. A **112**, 052820 (2025) - Published 17 November, 2025

Method for the accurate determination of two-photon transition frequencies as demonstrated with the cesium $6S_{1/2} \rightarrow 6D_{3/2}$ hyperfine transitions

Chia-Wei Chang (張家維), Bo-Wei Chen (陳伯煒), Wen-Chun Chen (陳玟君), Ko-Han Chen (陳可翰), Taro Mashimo (真下太郎), Tzu-Yu Shen (沈子淯), Po-Cheng Chang (張博程), and Wang-Yau Cheng (鄭王曜)

Phys. Rev. A **112**, 052821 (2025) - Published 18 November, 2025

Heavy-flavored hydrogen molecule systems

Hui-Min Yang, Yao Ma, and Shi-Lin Zhu

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Highly correlated electronic bounding and spin effect: Confirmation of an autodetaching state of O^-

M. M. Sant'Anna, A. A. Martínez-Calderón, Ginette Jalbert, A. B. Rocha, and G. Hinojosa

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Improved constraints on exotic electron-proton interactions in hydrogen

Lei Cong, Filip Ficek, Pavel Fadeev, and Dmitry Budker

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Electron capture and excitation in $He^+ + He$ collisions at intermediate and high energies

B. Mandal, T. Mistry, M. Mondal, and M. Purkait

Phys. Rev. A **112**, 052825 (2025) - Published 24 November, 2025

Effect of the $^{15}N\,(p,\alpha)\,^{12}C$ reaction on the kinetic energy release of water-molecule fragmentation

Zhuohang He, Zhencen He, Mingliang Duan, Junxiang Wu, Liyuan Deng, Ziqi Chen, Shuyu Zhang, and Zhimin Hu

Phys. Rev. A **112**, 052826 (2025) - Published 25 November, 2025

Wave-packet study of the mutual neutralization processes in low-energy lithium-hydrogen collisions

Maxim Yu. Yakovlev and Andrey K. Belyaev

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Light-induced processes in atomic-scale systems

Role of plasma waves in rescattering processes in intense laser fields

V. V. Strelkov, S. A. Bondarenko, and I. V. Smetanin

Phys. Rev. A **112**, 053101 (2025) - Published 3 November, 2025

Optical centrifuge with zero rotational acceleration

K. Wang, A. Hardikar, A. A. Milner, and V. Milner

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Analysis of extreme-ultraviolet vortex high-order harmonics generated by few-cycle Laguerre-Gaussian beams carrying orbital angular momentum

Shengfei Wu, Zhiming Yin, Jiaxin Han, Xiangyu Tang, Bincheng Wang, Chi Zhang, Jiahao You, Bin Lu, Ziyang Guo, Tanji Chen, and Cheng Jin

Phys. Rev. A **112**, 053103 (2025) - Published 3 November, 2025

High-efficiency quantum-state detection of ThF^+ with resonance-enhanced multiphoton asymmetric dissociation

Kia Boon Ng, Sun Yool Park, Anzhou Wang, Addison Hartman, Patricia Hector Hernandez, Rohan Kompella, Lan Cheng, Stephan Malbrunot-Ettenauer, Jun Ye, and Eric A. Cornell

Phys. Rev. A **112**, 053104 (2025) - Published 6 November, 2025

Comparison of continuum-continuum and Coulomb-laser-coupling delays from visible to midinfrared wavelengths

Brock Grafstrom and Alexandra S. Landsman

Phys. Rev. A **112**, 053105 (2025) - Published 6 November, 2025

Tunable enhancement of two-color-driven high-order harmonics from a gaseous medium

Zhi-Hong Jiao, Tian-Xiang Ma, Jin-Xu Du, Guo-Li Wang, Song-Feng Zhao, Lu Li, and Xiao-Xin Zhou

Phys. Rev. A **112**, 053106 (2025) - Published 7 November, 2025

Attosecond wave-packet interferometry using two-color XUV pulses

D. M. Villeneuve and Hiromichi Niikura

Phys. Rev. A **112**, 053107 (2025) - Published 10 November, 2025

Probing coherent electronic superpositions of singly and doubly excited states of krypton with extreme-ultraviolet four-wave-mixing spectroscopy

S. Yanez-Pagans, M. A. Alarcón, C. H. Greene, and A. Sandhu

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Revisiting the high-order harmonic generation from solids: The critical role of deep-lying valence bands

Cai-Ping Zhang, Li-Rong Chen, Ling-Yue Zhang, Yu-Zhi Chen, Hui-Fang Cui, and Xiang-Yang Miao

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Control of the photoelectron interference in XUV-assisted photoionization

Liding Li, Yongkun Chen, Jiawang Guo, Jia Tan, Yueming Zhou, and Peixiang Lu

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Comparison of nanoplasma ignition in helium nanodroplets induced by molecular and atomic dopants

Yue Hu, Zhengjun Ye, Jiaxuan Chen, Zihan Yu, Muze Li, Xinglei Long, Ruolin Gong, Zhejun Jiang, Menghang Shi, Wenbin Zhang, and Jian Wu

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Resonant versus nonresonant impulsive molecular alignment in acetylene via vibrational excitation

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EDITORS' SUGGESTION

Intense and controlled beam of $S(^1D_2)$ atoms

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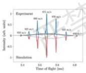

The authors report on the production of a beam of S($^1D_2$) atoms with a well-defined and tunable velocity, narrow velocity spreads, and a high quantum-state purity using a multistage Zeeman decelerator. The results could open the possibility of future studies of reactive and quenching processes involving S($^1D_2$) atoms at tunable and well-defined collision energies.

Effects of small-chain superexchange dynamics on spin-orbit-coupled clock spectroscopy

Mikhail Mamaev, Ana Maria Rey, and William R. Milner

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Rabi pulling effect in a compact cold-atom clock

Haojie Zhao, Bowen Yang, Yuhan Yan, Xuejie Li, Binghong Yu, Meifeng Ye, Ling Xiao, Jinyin Wan, Jianliao Deng, and Huadong Cheng

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Spectral phase control of an ultrashort pulse for exploring the Autler-Townes effect in hydrogen atomic ionization through a resonant state

An Yang, Wen-Quan Jing, Bing-Shuang Zhang, Li-Bao Fan, Lijuan Jia, and Chuan-Cun Shu

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Ultracold systems and matter waves

Parametric instability of ultracold Bose gases with long-range interaction and quantum fluctuations trapped in optical lattices