PHYSICAL REVIEW A™

For editorial and subscription correspondence, please see inside front cover
(ISSN: 2469-9926)

PERIODICALS
Postmaster send address changes to:

APS Subscription Services
P.O. Box 41
Annapolis Junction, MD 20701

THIRD SERIES, VOLUME 111, NUMBER 4
PARTS A AND B

CONTENTS

APRIL 2025

The Table of Contents is a total listing of Parts A and B.
Part A consists of pages L040201–042629, and Part B pages 042801–049903(E).

PART A

LETTERS

Fundamental concepts

Universal criticality of nonequilibrium quantum phase transition in a driven-dissipative Kerr cavity *(7 pages)* L040201
Jun-Yi Liu, Lei-Lei Nian, Nengji Zhou, Long Xiong, Jing-Tao Lü, and Bo Zheng

Thermodynamic phases in first detected return times of quantum many-body systems *(7 pages)* L040202
Benjamin Walter, Gabriele Perfetto, and Andrea Gambassi

Quantum information science

Protecting quantum information via many-body dynamical localization *(7 pages)* L040401
Ling-Zhi Tang, Dan-Wei Zhang, Hai-Feng Yu, and Z. D. Wang

Detecting quantum resources in a semi-device-independent framework *(6 pages)* L040402
Shubhayan Sarkar and Chandan Datta

Quantum technologies

Optimal sensing of photon addition and subtraction on nonclassical light *(7 pages)* L040601
Soumyabrata Paul, Arman, S. Lakshmibala, Prasanta K. Panigrahi, S. Ramanan, and V. Balakrishnan

Atomic and molecular structure and dynamics; high-precision experiments

Penning-trap mass measurement of ^{3}He *(6 pages)* L040801
O. Bezrodnova, S. Sasidharan, W. Quint, S. Sturm, and K. Blaum

Gaussian-basis-set approach to one-loop self-energy *(6 pages)* L040802
Dávid Ferenc, Maen Salman, and Trond Saue

Light-induced processes in atomic-scale systems

Complete retrieval of attosecond photoelectron dynamics from partially coherent states in entangled photoemission *(7 pages)* L041101
Morgan Berkane, Richard Taïeb, Gabriel Granveau, Pascal Salières, Charles Bourassin-Bouchet, Camille Lévêque, and Jérémie Caillat

Space-dependent photoelectron dynamics driven by intense vector vortex beams *(7 pages)* L041102
Alex Schimmoller, Spencer Walker, Harrison Pasquinilli, and Alexandra S. Landsman

(Continued)

2469-9926(202504)111:4:A;1-X

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A THIRD SERIES, VOLUME 111, NUMBER 4 APRIL 2025

Resonance nuclear excitation of the ^{229}Th nucleus via electronic bridge process in Th II *(7 pages)* L041103
V. A. Dzuba and V. V. Flambaum

Resonant stroboscopic Rydberg dressing: Electron-motion coupling and multibody interactions *(7 pages)* L041104
Chris Nill, Sylvain de Léséleuc, Christian Groß, and Igor Lesanovsky

Ultracold systems and matter waves

Scaling laws governing the collapse of a Bose-Einstein condensate *(7 pages)* L041301
Sebastian J. Morris, Christopher J. Ho, Simon M. Fischer, Jiří Etrych, Gevorg Martirosyan, Zoran Hadzibabic, and Christoph Eigen

Probing non-Gaussian correlations through entanglement generation in a many-body quantum system *(8 pages)* L041302
J. van de Kraats, D. J. M. Ahmed-Braun, V. E. Colussi, and S. J. J. M. F. Kokkelmans

ARTICLES

Fundamental concepts

Anomalous bulk-edge correspondence of the nonlinear Rice-Mele model *(10 pages)* 042201
Chenxi Bai and Zhaoxin Liang

Newton's laws of motion generating gravity-mediated entanglement *(13 pages)* 042202
Marta M. Marchese, Martin Plávala, Matthias Kleinmann, and Stefan Nimmrichter

Unified framework of unitarily residual measures for quantifying dissipation *(11 pages)* 042203
Tomohiro Nishiyama and Yoshihiko Hasegawa

Characterizing the Yang-Lee zeros of the classical Ising model through dynamic quantum phase transitions *(9 pages)* 042204
Mingtao Xu, Wei Yi, and De-Huan Cai

Pseudo-Hermitian topology in multiband non-Hermitian systems *(11 pages)* 042205
Jung-Wan Ryu, Jae-Ho Han, Chang-Hwan Yi, Hee Chul Park, and Moon Jip Park

Robust micro-macro entangled states *(9 pages)* 042206
Maryam Sadat Mirkamali and David G. Cory

Driving a quantum phase transition at an arbitrary rate: Exact solution of the transverse-field Ising model *(17 pages)* 042207
András Grabarits, Federico Balducci, and Adolfo del Campo

Disentangling connection between static and dynamical phase transitions *(9 pages)* 042208
Shihao Ye, Niaz Ali Khan, and Muhammad Sajid

Exploring Quantum contextuality with the quantum Möbius-Escher-Penrose hypergraph *(8 pages)* 042209
Mirko Navara and Karl Svozil

Certifying quantum randomness with disturbance *(9 pages)* 042210
Liang-Liang Sun, Xingjian Zhang, Xiang Zhou, Zheng-Da Li, Xiongfeng Ma, Jing-Yun Fan, and Sixia Yu

Expression for the decoherence rate due to air-molecule scattering in spatial qubits *(9 pages)* 042211
Martine Schut, Patrick Andriolo, Marko Toroš, Sougato Bose, and Anupam Mazumdar

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Eternal non-Markovianity of qubit maps *(4 pages)* 042212
Vinayak Jagadish and R. Srikanth

Quantum systems from random probabilistic automata *(24 pages)* 042213
A. Kreuzkamp and C. Wetterich

Sixth-order time-convolutionless master equation and beyond: Late-time resummations, two types of divergences, and the limits of validity *(40 pages)* 042214
Lance Lampert, Srikar Gadamsetty, Shantanu Chaudhary, Yiting Pei, Jiahao Chen, Elyana Crowder, and Dragomir Davidović

Spikes in Poissonian quantum trajectories *(21 pages)* 042215
Alan Sherry, Cedric Bernardin, Abhishek Dhar, Aritra Kundu, and Raphael Chetrite

Efficient wireless charging of a quantum battery *(13 pages)* 042216
Ming-Liang Hu, Ting Gao, and Heng Fan

Compatibility of quantum measurements and the emergence of classical objectivity *(5 pages)* 042217
Emery Doucet and Sebastian Deffner

Bayesian and frequentist estimators for the transition frequency of a driven two-level quantum system *(16 pages)* 042218
Chun Kit Dennis Law and József Zsolt Bernád

Quantum information science

Recovery of resources through sequential noisy measurements *(13 pages)* 042401
Sudipta Mondal, Pritam Halder, Amit Kumar Pal, and Aditi Sen(De)

Protecting entanglement witnesses with randomized measurements *(12 pages)* 042402
Jing-Tao Qiu, Wei-Jie Jiang, and Xiao-Dong Yu

Quantum imaginary time evolution and the unit-disk maximum independent set problem *(17 pages)* 042403
Victor A. Penas, Marcelo Losada, and Pedro W. Lamberti

Generally noise-resilient quantum gates for trapped ions *(15 pages)* 042404
Modesto Orozco-Ruiz, Wasim Rehman, and Florian Mintert

Phase-space analysis of Bell inequalities for mixed Gaussian states *(18 pages)* 042405
Gurpahul Singh, Kelly Wurtz, and Eduardo Martín-Martínez

Frequency-entangled W states and quantum frequency translation protocols via forward Brillouin interactions *(10 pages)* 042407
Andrew J. Shepherd and Ryan O. Behunin

Detectors for local discrimination of sets of generalized Bell states *(10 pages)* 042408
Cai-Hong Wang, Jiang-Tao Yuan, Ying-Hui Yang, Mao-Sheng Li, Shao-Ming Fei, and Zhi-Hao Ma

Selective continuous-variable quantum process tomography *(8 pages)* 042409
Virginia Feldman and Ariel Bendersky

Transfer of nonlocality between two- and three-qubit dissipative systems with counter-rotating-wave terms *(11 pages)* 042410
Zi-Yu Xiong, Yong-Jun Xiao, Ye-Qi Zhang, and Qi-Liang He

(Continued)

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Entanglement determination with a deep multiscale entanglement renormalization ansatz *(8 pages)* 042411
Kushagra Garg, Zeeshan Ahmed, and Andreas Thomasen

Second moment of Hafnians in Gaussian boson sampling *(39 pages)* 042412
Adam Ehrenberg, Joseph T. Iosue, Abhinav Deshpande, Dominik Hangleiter, and Alexey V. Gorshkov

Variational quantum eigensolver approach to prime factorization on IBM's noisy intermediate scale quantum computer *(12 pages)* 042413
Mona Sobhani, Yahui Chai, Tobias Hartung, and Karl Jansen

Degrees of entanglement in systems of three indistinguishable bosons: Revisiting the Greenberger-Horne-Zeilinger state *(9 pages)* 042414
P. Céspedes, F. H. Holik, and A. P. Majtey

Waiting time statistics for a double quantum dot coupled to an optical cavity *(7 pages)* 042415
Luis F. Santos and Gabriel T. Landi

Quantum variational autoencoder utilizing regularized mixed-state latent representations *(19 pages)* 042416
Gaoyuan Wang, Jonathan Warrell, Prashant S. Emani, and Mark Gerstein

Geometry of sets of Bargmann invariants *(12 pages)* 042417
Lin Zhang, Bing Xie, and Bo Li

Nonequivalence between absolute separability and positive partial transposition in the symmetric subspace *(9 pages)* 042418
Jonathan Louvet, Eduardo Serrano-Ensástiga, Thierry Bastin, and John Martin

Quantum permutation puzzles with indistinguishable particles *(15 pages)* 042419
Noah Lordi, Maedée Trank-Greene, Akira Kyle, and Joshua Combes

Single-shot quantum machine learning *(14 pages)* 042420
Erik Recio-Armengol, Jens Eisert, and Johannes Jakob Meyer

Macroscopic quantum teleportation with ensembles of qubits *(17 pages)* 042421
Manish Chaudhary, Zhiyuan Lin, Shuang Li, Mohan Zhang, Yuping Mao, Valentin Ivannikov, and Tim Byrnes

Global restrictions under local state discrimination *(7 pages)* 042422
Carles Roch i Carceller and Alexander Bernal

Quantum routing based on chiral state transfer in arbitrary N-node networks *(8 pages)* 042423
Wei Feng, Zuyan Wei, Guo-Qiang Zhang, Jun-Yao Li, Jun-Xiang Zhang, and Chui-Ping Yang

Topological blocking decoder for surface codes *(12 pages)* 042424
Hyunwoo Jung and Jeongseok Ha

Postselected amplification applied to the Mach-Zehnder interferometer for phase-shift measurement of optical coherent states *(7 pages)* 042425
Jialin Li, Yazhi Niu, Lupei Qin, and Xin-Qi Li

Experimental quantification of quantum coherence for a set of quantum states *(7 pages)* 042426
Tianle Zheng, Liangsheng Li, Wenting Zhou, and Chengjie Zhang

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Quantifying quantum-state texture *(9 pages)* 042427
Yiding Wang, Hui Liu, and Tinggui Zhang

Suppressing gauge drift in quantum simulations with gauge transformations *(9 pages)* 042428
Carter Ball

Nonconvex entanglement monotone determining the characteristic length of entanglement distribution in continuous-variable quantum networks *(12 pages)* 042429
Yaqi Zhao, Jinchuan Hou, Kan He, Nicolò Lo Piparo, and Xiangyi Meng

Quantum dissipative search via Lindbladians *(18 pages)* 042430
Peter J. Eder, Jernej Rudi Finžgar, Sarah Braun, and Christian B. Mendl

Dividing quantum circuits for the time evolution of stochastic processes by orthogonal-series-density estimation *(15 pages)* 042431
Koichi Miyamoto

Biasing quantum trajectories for enhanced sensing *(9 pages)* 042432
Theodoros Ilias

Binarization of multioutcome measurements in high-dimensional quantum correlation experiments *(7 pages)* 042433
Armin Tavakoli, Roope Uola, and Jef Pauwels

Quantum technologies

Generalized photon-number-splitting attack on a coherent one-way quantum-key-distribution protocol *(10 pages)* 042601
A. S. Avanesov and D. A. Kronberg

Time-optimal single-scalar control on a qubit of unitary dynamics *(15 pages)* 042602
Chungwei Lin, Qi Ding, Petros T. Boufounos, Yanting Ma, Yebin Wang, Dries Sels, and Chih-Chun Chien

Phases and phase transition in Grover's algorithm with systematic noise *(13 pages)* 042603
Sasanka Dowarah, Chuanwei Zhang, Vedika Khemani, and Michael Kolodrubetz

Qudit-native measurement protocol for dynamical correlations using Hadamard tests *(10 pages)* 042604
Pavel P. Popov, Kevin T. Geier, Valentin Kasper, Maciej Lewenstein, and Philipp Hauke

Entanglement-enhanced ac magnetometry in the presence of Markovian noise *(11 pages)* 042605
Thanaporn Sichanugrist, Hajime Fukuda, Takeo Moroi, Kazunori Nakayama, So Chigusa, Norikazu Mizuochi, Masashi Hazumi, and Yuichiro Matsuzaki

Controlled-squeeze gate in superconducting quantum circuits *(9 pages)* 042606
Nicolás F. Del Grosso, Rodrigo G. Cortiñas, Paula I. Villar, Fernando C. Lombardo, and Juan Pablo Paz

Qubits on programmable geometries with a trapped-ion quantum processor *(10 pages)* 042607
Qiming Wu, Yue Shi, and Jiehang Zhang

Unifying quantum spatial search, state transfer, and uniform sampling on graphs *(12 pages)* 042608
Qingwen Wang, Ying Jiang, Shiguang Feng, and Lvzhou Li

Geometric two-qubit gates in silicon-based double quantum dots *(9 pages)* 042609
Yong-Yang Lu, Kejin Wei, and Chengxian Zhang

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

High-precision many-body Ramsey spectroscopy with composite pulses *(17 pages)* 042611
Yuehua Pang, Yi Shen, Jiahao Huang, and Chaohong Lee

Asymptotic errors in adiabatic evolution *(5 pages)* 042612
Thomas D. Cohen and Hyunwoo Oh

Optimizing quantum transformation matrices: Block decomposition approach for efficient gate reduction *(10 pages)* 042613
Kin Man Lai and Xin Wang

Measurement and feedforward correction of the fast phase noise of lasers *(10 pages)* 042614
T. Denecker, Y. T. Chew, O. Guillemant, G. Watanabe, T. Tomita, K. Ohmori, and S. de Léséleuc

From quantum-enhanced to quantum-inspired Monte Carlo *(16 pages)* 042615
Johannes Christmann, Petr Ivashkov, Mattia Chiurco, and Guglielmo Mazzola

Variational quantum compiling for three-qubit-gate design in quantum dots *(11 pages)* 042616
Yuanyang Zhou, Huaxin He, Fengtao Pang, Hao Lyu, Yongping Zhang, and Xi Chen

Scaling of computational order parameters in Rydberg-atom graph states *(12 pages)* 042617
Zhangjie Qin and V. W. Scarola

Robust phase estimation of the ground-state energy without controlled time evolution on a quantum device *(8 pages)* 042618
Hiroki Kuji, Yuta Shingu, Tetsuro Nikuni, Takashi Imoto, Kenji Sugisaki, and Yuichiro Matsuzaki

Quantum trajectory approach to error mitigation *(11 pages)* 042619
Brecht I. C. Donvil, Rochus Lechler, Joachim Ankerhold, and Paolo Muratore-Ginanneschi

Expressibility, entangling power, and quantum average causal effect for causally indefinite circuits *(10 pages)* . . . 042620
Pedro C. Azado, Guilherme I. Correr, Alexandre Drinko, Ivan Medina, Askery Canabarro, and Diogo O. Soares-Pinto

Optimal connectivity from idle-qubit residual-coupling crosstalk in a cavity-mediated entangling gate *(10 pages)* 042621
A. Mammola, M. M. Desjardins, and Q. Schaeverbeke

Experimental study of time-dependent side channels in quantum key distribution *(12 pages)* 042622
Hao Tan, Weiyang Zhang, Liying Han, Sheng-Kai Liao, and Feihu Xu

Zeno-effect computation: Opportunities and challenges *(14 pages)* 042623
Jesse Berwald, Nicholas Chancellor, and Raouf Dridi

Smolyak-algorithm-assisted robust control of quantum systems with uncertainties *(8 pages)* 042624
Zigui Zhang, Zibo Miao, and Xiu-Hao Deng

High-order schemes for solving partial differential equations on a quantum computer *(18 pages)* 042625
Boris Arseniev, Dmitry Guskov, Richik Sengupta, and Igor Zacharov

Simulating quantum-classical interfaces via the Lindblad master equation *(18 pages)* 042626
Ali Passian, Joel Dawson, Stacy Prowell, and Warren Grice

Microwave continuous-variable quantum key distribution in the open air *(12 pages)* 042627
Yongxin Feng, Gang Xu, Xiu-Bo Chen, and Ying Guo

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Quantum-enhanced sensing with variable-range interactions *(14 pages)* 042628
Monika Mothsara, Leela Ganesh Chandra Lakkaraju, Srijon Ghosh, and Aditi Sen(De)

Optical phase estimation via homodyne measurement in the presence of photodetector saturation *(4 pages)* 042629
Jialin Li, Yazhi Niu, Lupei Qin, and Xin-Qi Li

PART B

Atomic and molecular structure and dynamics; high-precision experiments

Influence of plasma ions on the stopping power and the energy straggling of charged particles traversing hot plasmas *(11 pages)* 042801
C. D. Archubi and N. R. Arista

Dielectronic recombination studies on Fe^{2+} *(8 pages)* 042802
S. Singh and Z. Harman

Derivation of hierarchically correlated orbital functional theory: The role of hypercomplex orbitals *(12 pages)* . . . 042803
Ting Zhang and Neil Qiang Su

Fragmentation dynamics through geometrical distortion in low-energy electron attachment to carbon disulfide *(10 pages)* 042804
Anirban Paul, Daniel S. Slaughter, Sylwia Ptasinska, Dhananjay Nandi, Ian Carmichael, Jimena D. Gorfinkiel, and Dipayan Chakraborty

Blockwise perturbative corrections in multiconfiguration calculations based on configuration-state-function generators: A revised analysis of the W xxxviii spectrum *(15 pages)* 042805
Yanting Li, Chaofan Shi, Ran Si, Kai Wang, Per Jönsson, Gediminas Gaigalas, Michel Godefroid, and Chongyang Chen

Quantum-logic spectroscopy of an electron or positron for precise tests of the standard model *(7 pages)* 042806
Xing Fan, Atsushi Noguchi, and Kento Taniguchi

Ab initio calculations of electric dipole polarizabilities in the Li, Na, and K atoms *(11 pages)* 042807
A. Chakraborty and B. K. Sahoo

High-precision measurements of electric-dipole-transition amplitudes in excited states of ^{208}Pb using Faraday rotation spectroscopy *(13 pages)* 042808
John H. Lacy, Abby C. Kinney, and P. K. Majumder

Improved positron-molecule binding energies and estimations using molecular parameters *(16 pages)* 042809
J. R. Danielson, E. Arthur-Baidoo, and C. M. Surko

Vacuum polarization in molecules. I. Uehling interaction *(11 pages)* 042810
D. J. Flynn, H. M. Quiney, and I. P. Grant

Vacuum polarization in molecules. II. Higher-order corrections *(16 pages)* 042811
D. J. Flynn, H. M. Quiney, and I. P. Grant

Experimentally determined interatomic potentials in low-energy atomic collisions relevant for nuclear fusion *(15 pages)* 042812
Philipp M. Wolf, Eduardo Pitthan, and Daniel Primetzhofer

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Testing for isospin symmetry breaking by combining isotope shift measurements with precise calculations in potassium *(19 pages)* 042813
Vaibhav Katyal, A. Chakraborty, B. K. Sahoo, Ben Ohayon, Chien-Yeah Seng, Mikhail Gorchtein, and John Behr

Alignment-transfer rate coefficients for excitation of O V by electrons with an anisotropic two-temperature Maxwellian distribution *(15 pages)* 042814
A. F. Sekkal-Haddouche, M. K. Inal, and M. Benmouna

Electron emission in water molecules impacted by charged and neutral He^{q+} projectiles *(11 pages)* 042815
M. A. Quinto, N. J. Esponda, R. D. Rivarola, and J. M. Monti

Ultralong-range Rydberg molecules of Hg atoms *(11 pages)* 042816
Agata Wojciechowska, Michał Tomza, and Matthew T. Eiles

Facilitating role of hydrogen migration in the fragmentation dynamics of acetonitrile dications *(6 pages)* 042817
Qibo Ma, Jiaqi Zhou, Xiaorui Xue, Xintai Hao, Enliang Wang, and Xueguang Ren

Stepwise ionization of Mo^{14+} ions in an electron-beam ion trap: The importance of the metastable level *(8 pages)* 042818
Cunqiang Wu, Xiaobin Ding, Qi Guo, Jialin Liu, Ke Yao, Yunqing Fu, and Chenzhong Dong

Revisiting the hyperfine interval for the $2s2p\ ^3P_J$ state in ^{9}Be *(11 pages)* 042819
Yu-Shan Zhang, Wei Dang, Kai Wang, and Yong-Bo Tang

Two-loop electron self-energy with accelerated partial-wave expansion *(12 pages)* 042820
V. A. Yerokhin, Z. Harman, and C. H. Keitel

Testing relativistic atomic structure and bound-state quantum electrodynamics with Co-like ions *(8 pages)* 042821
R. Silwal, S. A. Blundell, S. C. Sanders, Dipti, H. Staiger, A. Hosier, M. G. Fuller, Yu. Ralchenko, and E. Takacs

Theoretical investigation of the laser-induced three-dimensional vibration excitation of neutral N_2Ar *(7 pages)* . . . 042822
Ting Xu, YinSong Tang, Xiaoqing Hu, JinPeng Ma, SiQi Pei, CongCong Jia, Yong Wu, and JianGuo Wang

Theoretical determination of the ionization potentials of ScF, YF, LaF, and AcF *(7 pages)* 042823
A. A. Kyuberis, L. F. Pašteka, E. Eliav, A. Sunaga, M. Au, S. G. Wilkins, and A. Borschevsky

Nonadiabatic-coupling-mediated argon dimer dissociation by slow and low-charge-state ion collisions *(5 pages)* 042824
Yu Zhang, Jiarong Wang, Xiaoqing Hu, Baihui Ren, Tianming Meng, Pufang Ma, Yueying Qi, Yong Wu, Jianguo Wang, Yaming Zou, Bingsheng Tu, Amine Cassimi, and Baoren Wei

Exact closed-form unitary transformations of fermionic operators *(10 pages)* 042825
Francesco A. Evangelista and Ilias Magoulas

Influence of the impact parameter for ionization of argon by fast positrons and electrons on the postcollision kinematics and triply differential spectra *(6 pages)* 042826
R. D. DuBois and K. Tőkési

Toward a full understanding of the physics of heavy-ion-induced inner-shell ionization *(7 pages)* 042827
Manpreet Kaur, Soumya Chatterjee, and T. Nandi

Exploring the enhancement of radiative recombination through field-induced recombination *(12 pages)* 042828
K. Q. Shi, Z. K. Huang, H. B. Wang, X. B. Zhu, S. Schippers, and X. Ma

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Light-induced processes in atomic-scale systems

Two-photon cooling of calcium atoms *(8 pages)* 043101
Wojciech Adamczyk, Silvan Koch, Claudia Politi, Henry Fernandes Passagem, Christoph Fischer, Pavel Filippov, Florence Berterottière, Daniel Kienzler, and Jonathan Home

Quantum beating and cyclic structures in the phase-space dynamics of the Kramers-Henneberger atom *(15 pages)* 043102
A. Tasnim Aynul, L. Cruz Rodriguez, and C. Figueira de Morisson Faria

Quantum tunneling without a barrier *(7 pages)* 043103
Anne Weber, Margarita Khokhlova, and Emilio Pisanty

Resolving distinct ionization channels via interferometric phase analysis of partial waves *(8 pages)* 043104
Tao Chen, Yi-Jia Mao, Yang Li, and Feng He

Coherent superposition mediating energy flow between fundamental and third-harmonic modes *(30 pages)* 043105
Petra Ruth Kaprálová-Žďánská

Impact of micromotion and field-axis misalignment on the excitation of Rydberg states of ions in a Paul trap *(18 pages)* 043106
Wilson S. Martins, Joseph W. P. Wilkinson, Markus Hennrich, and Igor Lesanovsky

Dalgarno-Lewis equation and its application to ultrafast two-photon processes: Short- and long-range terms for intermediate states *(14 pages)* 043107
D. I. R. Boll, A. Palacios, and O. A. Fojón

Statistical theory of cumulant mapping in an imperfect apparatus *(12 pages)* 043108
S. Patchkovskii and J. Mikosch

Electromagnetically-induced-transparency cooling with a tripod structure in a hyperfine trapped ion with mixed-species crystals *(9 pages)* 043109
Jenny J. Wu, Pan-Yu Hou, Stephen D. Erickson, Adam D. Brandt, Yong Wan, Giorgio Zarantonello, Daniel C. Cole, Andrew C. Wilson, Daniel H. Slichter, and Dietrich Leibfried

Time- and energy-domain interference in the dynamically dressed Rabi-cycling atom *(9 pages)* 043110
Yutong Deng, Xu Zhang, Yueming Zhou, and Peixiang Lu

High-order harmonic generation in quantum light by a generalized von Neumann lattice method *(14 pages)* 043111
Yi-Ben Wang and Xue-Bin Bian

Radiative cooling of the deprotonated cyan fluorescent protein chromophore anion *(9 pages)* 043112
James Flotte de Pouzols, Arun Subramani, Eleanor K. Ashworth, James N. Bull, Henrik Cederquist, Jordan Dezalay, Nanna Holmgaard List, Paul Martini, José E. Navarro Navarrete, Henning T. Schmidt, Henning Zettergren, Boxing Zhu, and Mark H. Stockett

Theoretical study of spin polarization in multiphoton ionization of the HI molecule *(8 pages)* 043113
Anton N. Artemyev, Eric Kutscher, Boris M. Lagutin, and Philipp V. Demekhin

Dissociative frustrated triple ionization of ArKr dimers induced by a linearly polarized two-color femtosecond laser field *(7 pages)* 043114
Junyang Ma, Shuqi Li, Yan Yang, and Zhenrong Sun

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A THIRD SERIES, VOLUME 111, NUMBER 4 APRIL 2025

Ultracold systems and matter waves

Stabilization of Bose-Bose mixtures on a spherical surface induced by the Lee-Huang-Yang correction *(10 pages)* 043301
Wen-Hao Li, Ming Gong, Zheng-Wei Zhou, and Xiang-Fa Zhou

Stationary states of a trapped SU(3) spin-orbit-coupled Bose gas with soft-core interaction *(9 pages)* 043302
Jia Liu, Jing Feng, Si-Lin Chen, Lin Wen, Wei Han, Xiao-Fei Zhang, and Xue-Ying Yang

Scattering halos in strongly interacting Feshbach molecular Bose-Einstein condensates *(9 pages)* 043303
Yuying Chen, Zhengxi Zhang, Chi-Kin Lai, Yun Liang, Hongmian Shui, Haixiang Fu, Fansu Wei, and Xiaoji Zhou

Quenching from superfluid to free bosons in two dimensions: Entanglement, symmetries, and the quantum Mpemba effect *(28 pages)* 043304
Shion Yamashika, Pasquale Calabrese, and Filiberto Ares

Effective tight-binding models in optical moiré potentials *(18 pages)* 043305
Dean Johnstone, Shanya Mishra, Zhaoxuan Zhu, and Laurent Sanchez-Palencia

Induced interactions and bipolarons in spin-orbit-coupled Bose-Einstein condensates *(7 pages)* 043306
Zhe Yang, Shanshan Ding, and Qizhong Zhu

Assessing small accelerations using a bosonic Josephson junction *(14 pages)* 043307
Rhombik Roy and Ofir E. Alon

Acceleration-driven dynamics of Josephson vortices in coplanar superfluid rings *(10 pages)* 043308
Yurii Borysenko, Nataliia Bazhan, Olena Prykhodko, Dominik Pfeiffer, Ludwig Lind, Gerhard Birkl, and Alexander Yakimenko

Acoustic black holes, white holes, and wormholes in Bose-Einstein condensates in two dimensions *(10 pages)* . . . 043309
Sachin Vaidya and Martin Kruczenski

Obstructed superfluid in the attractive Qi-Wu-Zhang-Hubbard model *(7 pages)* 043310
Beibing Huang, Chaofei Liu, and Ning Xu

Probing *p*-wave effects in spin-density separation of Bose mixtures with the dynamic structure factor *(11 pages)* 043311
Xiaoran Ye and Zhaoxin Liang

Inelastic quantum Boltzmann equation of single-component Fermi gases *(21 pages)* 043312
Xin-Yuan Gao and Yangqian Yan

Machine learning out-of-equilibrium correlations in the Bose-Hubbard model *(11 pages)* 043313
Ali Mokhtari-Jazi and Malcolm P. Kennett

Critical velocity for wake vortex generation behind a plate in a superflow *(8 pages)* 043314
Haruya Kokubo, Hiromitsu Takeuchi, and Kenichi Kasamatsu

Tunable intrinsic anomalous Hall effect in a shaken square optical lattice *(8 pages)* 043315
G.-B. Zhu, H.-M. Yang, Q. Sun, W.-M. Liu, and A.-C. Ji

Tunable pairing with local spin-dependent Rydberg molecule potentials in an atomic Fermi superfluid *(13 pages)* 043316
Chih-Chun Chien, Seth T. Rittenhouse, S. I. Mistakidis, and H. R. Sadeghpour

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Attractive and repulsive angulons in superfluid environments *(13 pages)* 043317
Wei Zhang, Zhongda Zeng, and Tao Shi

Maxon and roton solitons in a Rydberg-dressed Bose-Einstein condensate *(14 pages)* 043318
Yuxi Chen, Chao Hang, and Guoxiang Huang

Quantum network tomography of small Rydberg arrays by machine learning *(9 pages)* 043319
K. Mukherjee, J. Schachenmayer, S. Whitlock, and S. Wüster

Three-component Bose-Einstein condensates and wetting without walls *(18 pages)* 043320
Joseph O. Indekeu, Nguyen Van Thu, and Jonas Berx

Photonics, nonlinear optics, and optomechanics

Interferometric mass photometry at the quantum limit of sensitivity *(8 pages)* 043501
Fabian Müller, Emre Köse, Alfred J. Meixner, Erik Schäffer, and Daniel Braun

Precision gyroscope from the helicity of light *(7 pages)* 043502
Michael A. Fedderke, Roni Harnik, David E. Kaplan, Sam Posen, Surjeet Rajendran, Francesco Serra, and Vyacheslav P. Yakovlev

Coherent optical imaging of moving objects hidden in a heavily scattering random medium *(18 pages)* 043503
Ryan L. Hastings, David W. Alexander, and Kevin J. Webb

Enhancement of high-order harmonic generation based on Landau damping in laser interactions with plasma *(7 pages)* 043504
Li Xiong, Xin Chen, Pengfan Chen, Anrong Fan, Xiaobao Mao, Yuhao Feng, Yangfan He, and Xiaofei Lan

Unusual response of the chemical contribution to the plasmonic excited near field in enhanced Raman spectra of molecules on metal substrates *(11 pages)* 043505
Yixin Dai, Ling Yue, Wenxue Li, and Lin Pang

Pulse compression by photoexcitation-induced dynamics of Bragg mirrors *(6 pages)* 043506
Z. Ruziev, K. Yabana, and A. Husakou

Molecular optomechanically induced transparency *(12 pages)* 043507
Bin Yin, Jie Wang, Mei-Yu Peng, Qian Zhang, Deng Wang, Tian-Xiang Lu, Ke Wei, and Hui Jing

Application of Madelung hydrodynamics to plasmonics and nonlinear optics in two-dimensional materials *(12 pages)* 043508
Simão S. Cardoso, A. J. Chaves, N. Asger Mortensen, and N. M. R. Peres

Spectral enrichment of optical microresonator combs by means of a frequency-shifting loop *(8 pages)* 043509
Sergey N. Mantsevich, Ekaterina I. Kostyleva, Andrei N. Danilin, Darja A. Brukvina, Kirill N. Min'kov, and Nikita Yu. Dmitriev

Nonsymmetric evanescent coupling in photonics *(6 pages)* 043510
Rodrigo A. Vicencio, Diego Román-Cortés, Martín Rubio-Saldías, Paloma Vildoso, and Luis E. F. Foa Torres

Adaptive distributed-feedback semiconductor laser *(11 pages)* 043511
Chaoze Zhang, Tianyu Guan, Ligang Huang, Yujia Li, Laiyang Dang, Yuqin Mao, Lei Gao, Leilei Shi, Guolu Yin, Chaoyang Gong, and Tao Zhu

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Exploring non-Euclidean photonics: Pseudosphere microlaser *(15 pages)* 043512
H. Girin, S. Bittner, X. Checoury, D. Decanini, B. Dietz, A. Grigis, C. Lafargue, J. Zyss, C. Xu (徐晨妮), P. Sebbah, and M. Lebental

Observation of the Talbot effect from a surface-acoustic-wave dynamic grating *(9 pages)* 043513
M. Fisicaro, Y. C. Doedes, T. A. Steenbergen, M. P. van Exter, and W. Löffler

Pancharatnam-Berry phase and angular momentum of self-evolving vector Bessel beams *(10 pages)* 043514
Jiaqi Yang, Tommi K. Hakala, and Ari T. Friberg

Generation of non-Gaussian states in a cyclic four-wave-mixing system with photon-number projections *(8 pages)* 043515
Boxuan Jing, Feng-Xiao Sun, Yu Xiang, and Qiongyi He

Polarization and amplitude tuning of terahertz radiation from laser-induced air filaments *(7 pages)* 043516
Hanzhi Zhang, Linzheng Wang, Yanping Chen, Zhelin Zhang, and Zhengming Sheng

Generation of an ultrashort soliton train by pumping two identical time-delayed pulses in a third-order nonlinear composite medium *(9 pages)* 043517
Saili Zhao, Tongxing Sun, Shuo Liu, Ruijun Guo, and Yong Zeng

Intensity correlations in transmission and four-wave-mixing signals intermediated by hot rubidium atoms *(9 pages)* 043518
A. A. C. de Almeida, A. S. Alvarez, N. R. de Melo, M. R. L. da Motta, M. P. M. de Souza, and S. S. Vianna

Helicity-selected near-circularly polarized attosecond pulses generated from mixed He-Ne gases *(6 pages)* 043519
Chunyang Zhai, Xiaosong Zhu, Yingbin Li, Qingbin Tang, Benhai Yu, Pengfei Lan, and Peixiang Lu

Neutron beam shaping by ghost projection *(10 pages)* 043520
Andrew M. Kingston, Alaleh Aminzadeh, Lindon Roberts, Jeremy M. C. Brown, Filomena Salvemini, Joseph J. Bevitt, Ulf Garbe, and David M. Paganin

Optomechanically induced transparency on exceptional surfaces *(10 pages)* 043521
Yang Pan, H.-L. Zhang, Y.-F. Jiao, Y. Wang, D.-Y. Wang, S.-L. Su, and Hui Jing

Shaping terahertz harmonic frequency combs with frequency-dependent external reflectors *(7 pages)* 043522
Carlo Silvestri, Xiaoqiong Qi, Thomas Taimre, and Aleksandar D. Rakić

Solving the inverse problem for the design of omnidirectional lenses with an ultimately high numerical aperture *(7 pages)* 043523
Shay Rabani, Kirill Shvalb, Boris Malomed, and Tal Carmon

Corrections to the optomechanical Hamiltonian from quadratic fluctuations of a moving mirror *(10 pages)* 043524
Salvatore Butera

Measurement of the inner horizon in the analog of rotating Bañado-Teitelboim-Zanelli black holes by an improved photon fluid *(7 pages)* 043525
Siyao Wu, Ling Chen, Bolong Yi, Lei Li, and Baocheng Zhang

Modulating a photonic graphene lattice by the Lorentz-like transformation *(8 pages)* 043526
Zhuo Zhang (张卓), Milivoj R. Belić, Yongdong Li (李永东), Tao Wang (王涛), and Yiqi Zhang (张贻齐)

Topological $\pi/2$ modes in photonic waveguide arrays *(6 pages)* 043527
Gang Jiang, Siyuan Zhang, Weiwei Zhu, Y. X. Zhao, and Haoran Xue

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Collective explosive dynamics of soliton rains in a figure-8 Tm-doped fiber laser *(11 pages)* 043528
Bo Yang Su, Jin Jer Huang, Ze Xin Du, and Xin Lu Zhang

Energy scalability limits of dissipative solitons *(14 pages)* 043529
Vladimir L. Kalashnikov, Alexander Rudenkov, Evgeni Sorokin, and Irina T. Sorokina

Formulation of threshold excitation intensity for light amplification in organic whispering-gallery-mode resonators *(7 pages)* 043530
Kazuki Imada, Seina Miyamoto, Takeshi Komino, Tokuji Yokomatsu, and Kazusuke Maenaka

Quantum optics

Large-baseline quantum telescopes assisted by partially distinguishable photons *(9 pages)* 043701
Subhrajit Modak and Pieter Kok

Correlated relaxation and emerging entanglement in arrays of Λ-type atoms *(8 pages)* 043702
Denis Ilin, Alexander V. Poshakinskiy, and Alexander S. Solntsev

Strongly quadrature-squeezed light from a single multilevel atom *(7 pages)* 043703
Alex Elliott and Scott Parkins

Extended analysis of distillation and purification of squeezed states of light *(10 pages)* 043704
Jaromír Fiurášek, Stephan Grebien, and Roman Schnabel

Correlating two qubits via a common cavity *(8 pages)* 043705
Amit Dey

Critical spectrum of the anisotropic two-photon quantum Rabi model *(12 pages)* 043706
Jiong Li, Daniel Braak, and Qing-Hu Chen

Designing a compact cavity-enhanced source of entangled photons *(10 pages)* 043707
Žiga Pušavec, Lara Ulčakar, and Rainer Kaltenbaek

Tunable photonic spin Hall effect in a tripod atom-light configuration *(8 pages)* 043708
Muqaddar Abbas, Pei Zhang, and Hamid R. Hamedi

Stability of macroscopic spin ensembles against inhomogeneous dephasing *(11 pages)* 043709
Wai-Keong Mok, Leong-Chuan Kwek, and Steven Touzard

Exotic behavior of parity in the superradiant phase of the quantum Rabi model *(9 pages)* 043710
Yun-Tong Yang, Junpeng Liu, and Hong-Gang Luo

Programmable integrated source of polarization and frequency-bin hyperentangled photon pairs *(12 pages)* 043711
Colin Vendromin, J. E. Sipe, and Marco Liscidini

Quantum hyperspins: Highly nonclassical collective behavior in quantum-optical parametric oscillators *(13 pages)* 043712
Marcello Calvanese Strinati and Claudio Conti

Targeted quantum routing of single photons in a giant-atom waveguide-QED system *(10 pages)* 043713
Yong Wang, Wen-An Li, and Yuan Chen

Nonreciprocal photon blockade induced by parametric amplification in an asymmetrical cavity *(11 pages)* 043714
Shao-Xiong Wu, Xue-Chen Gao, Huan-Huan Cheng, and Cheng-Hua Bai

(Continued)

The editors and referees of PRA find these papers to be of particular interest, importance, or clarity. Please see our Announcement Phys. Rev. A 88, 020001 (2013).

PHYSICAL REVIEW A **THIRD SERIES, VOLUME 111, NUMBER 4** **APRIL 2025**

Direct experimental observation of sub-Poissonian photon statistics by means of multiphoton scattering on a two-level system *(11 pages)* 043715
A. Yu. Dmitriev, A. V. Vasenin, S. A. Gunin, S. V. Remizov, A. A. Elistratov, W. V. Pogosov, and O. V. Astafiev

Superradiant phase transitions in the quantum Rabi model: Overcoming the no-go theorem through anisotropy *(9 pages)* 043716
Tian Ye, Yan-Zhi Wang, Xiang-You Chen, Qing-Hu Chen, and Hai-Qing Lin

Single-photon isolation and nonreciprocal frequency conversion in atom-waveguide systems *(12 pages)* 043717
Jun-Cong Zheng, Xiao-Wei Zheng, Xin-Lei Hei, Yi-Fan Qiao, Xiao-Yu Yao, Xue-Feng Pan, Yu-Meng Ren, Xiao-Wen Huo, and Peng-Bo Li

Quantum squeezed-reservoir engineering in Laguerre-Gaussian cavity optomechanics *(9 pages)* 043718
Rongfang Liu and Jun-Hong An

Purification of Gaussian states by photon subtraction or addition *(8 pages)* 043719
Kun Zhang, Huijun Li, Jietai Jing, Nicolas Treps, and Mattia Walschaers

ERRATA

Erratum: Quantum state exclusion through offset measurement [Phys. Rev. A **110**, 042211 (2024)] *(1 page)* . . . . . 049901(E)
Caleb McIrvin, Ankith Mohan, and Jamie Sikora

Erratum: Robustness of optimal probabilistic storage and retrieval of unitary channels to noise [Phys. Rev. A **106**, 052416 (2022)] *(1 page)* . . . . . 049902(E)
Jaroslav Pavličko and Mário Ziman

Erratum: Long-distance distribution of qubit-qubit entanglement using Gaussian-correlated photonic beams [Phys. Rev. A **105**, 062454 (2022)] *(2 pages)* . . . . . 049903(E)
J. Agustí, Y. Minoguchi, J. M. Fink, and P. Rabl