# PHYSICAL REVIEW A

**For editorial and subscription correspondence, please see inside front cover**
**(ISSN: 1050-2947)**

**PERIODICALS**
**Postmaster send address changes to:**
**APS Subscription Services**
**Suite 1NO1**
**2 Huntington Quadrangle**
**Melville, NY 11747-4502**

**THIRD SERIES, VOLUME 79, NUMBER 4**
**PARTS A AND B**

*CONTENTS*

**APRIL 2009**

***The Table of Contents is a total listing of Parts A and B.***
***Part A consists of pages 040101(R)-043204, and Part B pages 043401-049903(E).***

## PART A

## RAPID COMMUNICATIONS

**Fundamental concepts**

Thermal Casimir effect between random layered dielectrics *(4 pages)* . . . . . 040101(R)
David S. Dean, R. R. Horgan, Ali Naji, and R. Podgornik

**Quantum information**

Entanglement renormalization, scale invariance, and quantum criticality *(4 pages)* . . . . . 040301(R)
Robert N. C. Pfeifer, Glen Evenbly, and Guifré Vidal

High-fidelity entanglement swapping with fully independent sources *(4 pages)* . . . . . 040302(R)
Rainer Kaltenbaek, Robert Prevedel, Markus Aspelmeyer, and Anton Zeilinger

Implementing topological quantum manipulation with superconducting circuits *(4 pages)* . . . . . 040303(R)
Zheng-Yuan Xue, Shi-Liang Zhu, J. Q. You, and Z. D. Wang

Reversible state transfer between superconducting qubits and atomic ensembles *(4 pages)* . . . . . 040304(R)
David Petrosyan, Guy Bensky, Gershon Kurizki, Igor Mazets, Johannes Majer, and Jörg Schmiedmayer

Optimal estimation of losses at the ultimate quantum limit with non-Gaussian states *(4 pages)* . . . . . 040305(R)
G. Adesso, F. Dell'Anno, S. De Siena, F. Illuminati, and L. A. M. Souza

**Atomic and molecular structure and dynamics**

Density-matrix-power functional: Performance for finite systems and the homogeneous electron gas *(4 pages)* . . . . . 040501(R)
N. N. Lathiotakis, S. Sharma, J. K. Dewhurst, F. G. Eich, M. A. L. Marques, and E. K. U. Gross

**Atomic and molecular collisions and interactions**

Prediction of Feshbach resonances from three input parameters *(4 pages)* . . . . . 040701(R)
Thomas M. Hanna, Eite Tiesinga, and Paul S. Julienne

**Copyright 2009 by The American Physical Society**

*(Continued)*

1050-2947(200904)79:4:A;1-2

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

**Clusters (including fullerenes)**

Ionization and charge migration through strong internal fields in clusters exposed to intense x-ray pulses *(4 pages)* . . . . . 041201(R)
Christian Gnodtke, Ulf Saalmann, and Jan M. Rost

**Atomic and molecular processes in external fields, including interactions with strong fields and short pulses**

Effects of electron structure and multielectron dynamical response on strong-field multiphoton ionization of diatomic molecules with arbitrary orientation: An all-electron time-dependent density-functional-theory approach *(4 pages)* . . . . . 041401(R)
Dmitry A. Telnov and Shih-I Chu (朱時宜)

Magneto-optical trapping of barium *(4 pages)* . . . . . 041402(R)
S. De, U. Dammalapati, K. Jungmann, and L. Willmann

Exploiting the composite character of Rydberg atoms for cold-atom trapping *(4 pages)* . . . . . 041403(R)
Michael Mayle, Igor Lesanovsky, and Peter Schmelcher

Controllable supercontinuum generation by the quantum wake of molecular alignment *(4 pages)* . . . . . 041404(R)
Jian Wu, Hua Cai, Yan Peng, and Heping Zeng

**Matter waves**

Trap-modulation spectroscopy of the Mott-insulator transition in optical lattices *(4 pages)* . . . . . 041601(R)
H. Lignier, A. Zenesini, D. Ciampini, O. Morsch, E. Arimondo, S. Montangero, G. Pupillo, and R. Fazio

Dipole oscillations of confined lattice bosons in one dimension *(4 pages)* . . . . . 041602(R)
Simone Montangero, Rosario Fazio, Peter Zoller, and Guido Pupillo

Paired states in spin-imbalanced atomic Fermi gases in one dimension *(4 pages)* . . . . . 041603(R)
Paata Kakashvili and C. J. Bolech

Mott insulator of ultracold alkaline-earth-metal-like atoms *(4 pages)* . . . . . 041604(R)
Takeshi Fukuhara, Seiji Sugawa, Masahito Sugimoto, Shintaro Taie, and Yoshiro Takahashi

**Quantum optics, physics of lasers, nonlinear optics, classical optics**

Observation of near-field correlations in spontaneous parametric down-conversion *(4 pages)* . . . . . 041801(R)
H. Di Lorenzo Pires and M. P. van Exter

Complexity of two-dimensional quasimodes at the transition from weak scattering to Anderson localization *(4 pages)* . . . . . 041802(R)
C. Vanneste and P. Sebbah

Resonant plasmon-soliton interaction *(4 pages)* . . . . . 041803(R)
Konstantin Y. Bliokh, Yury P. Bliokh, and Albert Ferrando

Nonlinear light propagation in rotating waveguide arrays *(4 pages)* . . . . . 041804(R)
Shu Jia and Jason W. Fleischer

Generation of optical combs in a whispering gallery mode resonator from a bichromatic pump *(4 pages)* . . . . 041805(R)
Dmitry V. Strekalov and Nan Yu

Why do superluminal pulses become subluminal once they go far enough? *(4 pages)* . . . . . 041806(R)
Lipsa Nanda, Harshawardhan Wanare, and S. Anantha Ramakrishna

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

## ARTICLES

### Fundamental concepts

Experimental violation of a Bell inequality with two different degrees of freedom of entangled particle pairs *(5 pages)* . . . . . 042101
Xiao-song Ma, Angie Qarry, Johannes Kofler, Thomas Jennewein, and Anton Zeilinger

Existence and nonexistence of an intrinsic tunneling time *(10 pages)* . . . . . 042102
Gonzalo Ordonez and Naomichi Hatano

Stochastic wave-function unraveling of the generalized Lindblad master equation *(5 pages)* . . . . . 042103
Mervlyn Moodley and Francesco Petruccione

Madelung fluid model for the most likely wave function of a single free particle in a two-dimensional space with a given average energy *(8 pages)* . . . . . 042104
Agung Budiyono and Ken Umeno

Nonclassicality of states and measurements by breaking classical bounds on statistics *(12 pages)* . . . . . 042105
Ángel Rivas and Alfredo Luis

Bounding the dimension of bipartite quantum systems *(9 pages)* . . . . . 042106
Tamás Vértesi and Károly F. Pál

Bohr–van Leeuwen theorem and the thermal Casimir effect for conductors *(11 pages)* . . . . . 042107
Giuseppe Bimonte

Phase shifts in nonresonant coherent excitation *(9 pages)* . . . . . 042108
Boyan T. Torosov and Nikolay V. Vitanov

Quantum entanglement in a noncommutative system *(18 pages)* . . . . . 042109
S. Adhikari, B. Chakraborty, A. S. Majumdar, and S. Vaidya

### Quantum information

Robust quantum repeater with atomic ensembles against phase and polarization instability *(4 pages)* . . . . . 042301
Ming Gao, Lin-Mei Liang, Cheng-Zu Li, and Xiang-Bin Wang

Sudden death and sudden birth of entanglement in common structured reservoirs *(4 pages)* . . . . . 042302
L. Mazzola, S. Maniscalco, J. Piilo, K.-A. Suominen, and B. M. Garraway

Classical capacity of a qubit depolarizing channel with memory *(7 pages)* . . . . . 042303
Jeroen Wouters, Mark Fannes, Ismail Akhalwaya, and Francesco Petruccione

Time-optimal generation of cluster states *(5 pages)* . . . . . 042304
Robert Fisher, Haidong Yuan, Andreas Spörl, and Steffen Glaser

Quantum simulations based on measurements and feedback control *(5 pages)* . . . . . 042305
K. G. H. Vollbrecht and J. I. Cirac

Quantum teleportation scheme by selecting one of multiple output ports *(13 pages)* . . . . . 042306
Satoshi Ishizaka and Tohya Hiroshima

Spectral effects of strong $\chi^{(2)}$ nonlinearity for quantum processing *(8 pages)* . . . . . 042307
Patrick M. Leung, William J. Munro, Kae Nemoto, and Timothy C. Ralph

Matrix product states: Symmetries and two-body Hamiltonians *(10 pages)* . . . . . 042308
M. Sanz, M. M. Wolf, D. Pérez-García, and J. I. Cirac

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Constructing two-qubit gates with minimal couplings *(4 pages)* . . . . . 042309
Haidong Yuan, Robert Zeier, Navin Khaneja, and Seth Lloyd

Relationship between probabilities of the state transfers and entanglements in spin systems with simple geometrical configurations *(14 pages)* . . . . . 042310
S. I. Doronin, E. B. Fel'dman, and A. I. Zenchuk

High-fidelity atomic-state teleportation protocol with non-maximally-entangled states *(7 pages)* . . . . . 042311
Grzegorz Chimczak and Ryszard Tanaś

Optimal positive-operator-valued measures for unambiguous state discrimination *(12 pages)* . . . . . 042312
Boris F. Samsonov

Thermal robustness of multipartite entanglement of the one-dimensional spin-$\frac{1}{2}$ *XY* model *(10 pages)* . . . . . 042313
Yoshifumi Nakata, Damian Markham, and Mio Murao

Quantum-information storage: A Schrödinger-picture approach *(13 pages)* . . . . . 042314
P. R. Berman and J.-L. Le Gouët

Augmented message-matrix approach to deterministic dense-coding theory *(8 pages)* . . . . . 042315
E. Gerjuoy, H. T. Williams, and P. S. Bourdon

Controlled-NOT logic with nonresonant Josephson phase qubits *(13 pages)* . . . . . 042316
Andrei Galiautdinov

Entanglement and level crossings in frustrated ferromagnetic rings *(7 pages)* . . . . . 042317
Masudul Haque, V. Ravi Chandra, and Jayendra N. Bandyopadhyay

Stabilizer dimension of graph states *(4 pages)* . . . . . 042318
D. H. Zhang, H. Fan, and D. L. Zhou

Dzyaloshinskii-Moriya interaction and anisotropy effects on the entanglement of the Heisenberg model *(7 pages)* . . . . . 042319
M. Kargarian, R. Jafari, and A. Langari

Imitating quantum mechanics: Qubit-based model for simulation *(8 pages)* . . . . . 042320
Steven Peil

Quantum pattern recognition with liquid-state nuclear magnetic resonance *(7 pages)* . . . . . 042321
Rodion Neigovzen, Jorge L. Neves, Rudolf Sollacher, and Steffen J. Glaser

Performance of a quantum teleportation protocol based on temporally resolved photodetection of collective spontaneous emission *(9 pages)* . . . . . 042322
Richard Wagner, Jr. and James P. Clemens

Mapping two-qubit operators onto projective geometries *(6 pages)* . . . . . 042323
A. R. P. Rau

Enhancement of entanglement percolation in quantum networks via lattice transformations *(11 pages)* . . . . . 042324
G. John Lapeyre, Jr., Jan Wehr, and Maciej Lewenstein

Signatures of nonclassicality in mixed-state quantum computation *(8 pages)* . . . . . 042325
Animesh Datta and Sevag Gharibian

Maximal success probabilities of linear-optical quantum gates *(4 pages)* . . . . . 042326
Dmitry B. Uskov, Lev Kaplan, A. Matthew Smith, Sean D. Huver, and Jonathan P. Dowling

Deterministic quantum-public-key encryption: Forward search attack and randomization *(5 pages)* . . . . . 042327
Georgios M. Nikolopoulos and Lawrence M. Ioannou

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Error characterization in quantum information processing: A protocol for analyzing spatial correlations and its experimental implementation *(6 pages)* . . . . . 042328
Cecilia C. López, Benjamin Lévi, and David G. Cory

Symmetric extension in two-way quantum key distribution *(10 pages)* . . . . . 042329
Geir Ove Myhr, Joseph M. Renes, Andrew C. Doherty, and Norbert Lütkenhaus

Interfacing with Hamiltonian dynamics *(9 pages)* . . . . . 042330
Alastair Kay

Indirect spin dephasing via charge-state decoherence in optical control schemes in quantum dots *(5 pages)* . . . . . 042331
A. Grodecka, P. Machnikowski, and J. Förstner

Long-distance quantum communication with individual atoms and atomic ensembles *(5 pages)* . . . . . 042332
Gong-Wei Lin, Xu-Bo Zou, Xiu-Min Lin, and Guang-Can Guo

Generating entangled fermions by accelerated measurements on the vacuum *(4 pages)* . . . . . 042333
David C. M. Ostapchuk and Robert B. Mann

Spin squeezing and entanglement *(13 pages)* . . . . . 042334
Géza Tóth, Christian Knapp, Otfried Gühne, and Hans J. Briegel

Efficient quantum algorithm for preparing molecular-system-like states on a quantum computer *(9 pages)* . . . 042335
Hefeng Wang, S. Ashhab, and Franco Nori

Linear optical generation of multipartite entanglement with conventional photon detectors *(8 pages)* . . . . . 042336
Hong-Fu Wang and Shou Zhang

Representation of entanglement by negative quasiprobabilities *(8 pages)* . . . . . 042337
J. Sperling and W. Vogel

Quantum logical gates with linear quadripartite cluster states of continuous variables *(10 pages)* . . . . . 042338
Aihong Tan, Changde Xie, and Kunchi Peng

Quantum-information transfer in a coupled resonator waveguide *(4 pages)* . . . . . 042339
Peng-Bo Li, Ying Gu, Qi-Huang Gong, and Guang-Can Guo

Quantum repeaters based on single trapped ions *(6 pages)* . . . . . 042340
Nicolas Sangouard, Romain Dubessy, and Christoph Simon

Generation of Greenberger-Horne-Zeilinger and *W* states for stationary qubits in a spin network via resonance scattering *(8 pages)* . . . . . 042341
L. Jin and Z. Song

Entanglement-enhanced quantum error-correcting codes *(5 pages)* . . . . . 042342
Ying Dong (董莹), Xiuhao Deng (邓修豪), Mingming Jiang (姜明明), Qing Chen (陈清), and Sixia Yu (郁司夏)

**Atomic and molecular structure and dynamics**

Hyperfine constants of low-lying states of $^{135}Ba^{+}$ *(5 pages)* . . . . . 042501
Kai-zhi Yu

Oscillator strength measurements of the $5s6s\ ^1S_0 \rightarrow 5snp\ ^1P_1$ Rydberg transitions of strontium *(6 pages)* . . . . 042502
S. U. Haq, M. A. Kalyar, M. Rafiq, R. Ali, N. K. Piracha, and M. A. Baig

Calculation of Stark-induced absorption on the $6s6p\ ^3P_1 - 6s^2\ ^1S_0$ transition in Hg *(6 pages)* . . . . . 042503
K. Beloy, V. A. Dzuba, and A. Derevianko

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

*K*-shell double photoionization of Be, Mg, and Ca *(9 pages)* . . . . . 042504
A. S. Kheifets, Igor Bray, and J. Hoszowska

Exchange interaction and correlations radically change behavior of a quantum particle in a classically forbidden region *(4 pages)* . . . . . 042505
V. V. Flambaum

Exchange energy density in density-functional theory via the Dirac density matrix for a nonrelativistic 10-electron atomic ion compared with Becke's proposal for a gradient-corrected local-density-approximation result *(7 pages)* . . . . . 042506
M. L. Glasser, N. H. March, and L. M. Nieto

Analysis of the xuv photoabsorption spectrum of $Au^{2+}$, $Au^{3+}$, and $Au^{4+}$ *(8 pages)* . . . . . 042507
M. G. Su, C. Z. Dong, N. Murphy, and G. O'Sullivan

Dissociative recombination of antiprotonic helium ions: $e+\bar{p}He^{2+}\rightarrow\bar{p}+He^{+}$ *(7 pages)* . . . . . 042508
Kazuhiro Sakimoto

Transitions and the effects of configuration interaction in the spectra of Sn XV–Sn XVIII *(7 pages)* . . . . . 042509
R. D'Arcy, H. Ohashi, S. Suda, H. Tanuma, S. Fujioka, H. Nishimura, K. Nishihara, C. Suzuki, T. Kato, F. Koike, J. White, and G. O'Sullivan

Efficient computation of the dispersion interaction with density-functional theory *(10 pages)* . . . . . 042510
Jing Kong, Zhengting Gan, Emil Proynov, Marek Freindorf, and Thomas R. Furlani

**Atomic and molecular collisions and interactions**

Electron-induced bond breaking at low energies in HCOOH and glycine: The role of very short-lived $\sigma^*$ anion states *(7 pages)* . . . . . 042701
Gordon A. Gallup, Paul D. Burrow, and Ilya I. Fabrikant

Emission cross sections for electron-impact excitation of zinc atoms *(11 pages)* . . . . . 042702
S. A. Napier, D. Cvejanović, J. F. Williams, L. Pravica, D. Fursa, I. Bray, O. Zatsarinny, and K. Bartschat

Nonadiabaticity and large fluctuations in a many-particle Landau-Zener problem *(22 pages)* . . . . . 042703
Alexander Altland, V. Gurarie, T. Kriecherbauer, and A. Polkovnikov

Rotationally adapted studies of *ab initio*–computed collision-induced hyperpolarizabilities: The $H_2$-Ar pair *(8 pages)* . . . . . 042704
Tadeusz Bancewicz and George Maroulis

Efimov effect from functional renormalization *(16 pages)* . . . . . 042705
S. Moroz, S. Floerchinger, R. Schmidt, and C. Wetterich

Radiative charge transfer in collisions of $H^+$ with Na at very low energies *(5 pages)* . . . . . 042706
C. H. Liu, Y. Z. Qu, Y. Zhou, J. G. Wang, Y. Li, and R. J. Buenker

Differential and total cross sections for antiproton-impact ionization of atomic hydrogen and helium *(16 pages)* . . . . . 042707
M. McGovern, D. Assafrão, J. R. Mohallem, Colm T. Whelan, and H. R. J. Walters

Role of elastic projectile-electron scattering in double ionization of helium by fast proton impact *(7 pages)* . . . . . 042708
M. Schulz, M. F. Ciappina, T. Kirchner, D. Fischer, R. Moshammer, and J. Ullrich

Dissociative excitation of $H_2S$ by electron impact *(11 pages)* . . . . . 042709
S. J. Brotton, E. Vyskocil, W. Kedzierski, and J. W. McConkey

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Electron loss of fast heavy projectiles in collision with neutral targets *(8 pages)* . . . . . 042710
V. I. Matveev, S. V. Ryabchenko, D. U. Matrasulov, Kh. Yu. Rakhimov, S. Fritzsche, and Th. Stöhlker

Effects of electric fields on heteronuclear Feshbach resonances in ultracold $^{6}$Li-$^{87}$Rb mixtures *(10 pages)* . . . 042711
Z. Li and K. W. Madison

Spin-resolved electron-impact excitation of the $6s6p$ $(J=1)$ states in mercury *(7 pages)* . . . . . 042712
F. Jüttemann, G. F. Hanne, O. Zatsarinny, and K. Bartschat

Fully relativistic *B*-spline *R*-matrix calculations for electron collisions with mercury *(9 pages)* . . . . . 042713
O. Zatsarinny and K. Bartschat

Scattering of low-energy electrons by $C_2H_4O$ *(6 pages)* . . . . . 042714
T. C. Freitas and M. H. F. Bettega

Alignment relaxation of $Ne^{*}(2p_i[J=1])$ atoms induced by collisions with $He(1s^2)$ atoms in discharges at temperatures from 10 to 3000 K *(8 pages)* . . . . . 042715
Cristian Bahrim and Vaibhav V. Khadilkar

Coupled system $a\ ^3\Sigma^+$ and $X\ ^1\Sigma^+$ of KLi: Feshbach resonances and corrections to the Born-Oppenheimer approximation *(11 pages)* . . . . . 042716
E. Tiemann, H. Knöckel, P. Kowalczyk, W. Jastrzebski, A. Pashov, H. Salami, and A. J. Ross

Alternative choices of Coulomb channel functions *(12 pages)* . . . . . 042717
R. Guérout, Ch. Jungen, H. Oueslati, S. C. Ross, and M. Telmini

Observation of interspecies Feshbach resonances in an ultracold Rb-Cs mixture *(7 pages)* . . . . . 042718
K. Pilch, A. D. Lange, A. Prantner, G. Kerner, F. Ferlaino, H.-C. Nägerl, and R. Grimm

**Photon, electron, atom, and molecule interactions with solids and surfaces**

Stopping power of antiprotons in H, $H_2$, and He targets *(13 pages)* . . . . . 042901
Armin Lühr and Alejandro Saenz

Guided transmission of $Ne^{7+}$ ions through nanocapillaries in insulating polymers: Scaling laws for projectile energies up to 50 keV *(8 pages)* . . . . . 042902
N. Stolterfoht, R. Hellhammer, Z. Juhász, B. Sulik, V. Bayer, C. Trautmann, E. Bodewits, A. J. de Nijs, H. M. Dang, and R. Hoekstra

Reexamination of the theory of light-induced atomic desorption *(8 pages)* . . . . . 042903
Krzysztof Ręblas and Marek J. Kasprowicz

Experimental and theoretical study of the energy loss of Be and B ions in Zn *(6 pages)* . . . . . 042904
E. D. Cantero, R. C. Fadanelli, C. C. Montanari, M. Behar, J. C. Eckardt, G. H. Lantschner, J. E. Miraglia, and N. R. Arista

Modification of glass cell walls by rubidium vapor *(5 pages)* . . . . . 042905
J. Ma, A. Kishinevski, Y.-Y. Jau, C. Reuter, and W. Happer

Impact of magnetic properties on atom-wall interactions *(7 pages)* . . . . . 042906
G. Bimonte, G. L. Klimchitskaya, and V. M. Mostepanenko

**Clusters (including fullerenes)**

Fast charged-particle impact ionization of endohedral atoms *(9 pages)* . . . . . 043201
A. S. Baltenkov, V. K. Dolmatov, S. T. Manson, and A. Z. Msezane

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Structural and electronic properties of 13-atom 4*d* transition-metal clusters *(9 pages)* . . . . . 043202
Yan Sun, René Fournier, and Min Zhang

Density-functional-theory study of 13-atom metal clusters $M_{13}$, $M$=Ta–Pt *(10 pages)* . . . . . 043203
Min Zhang and René Fournier

Parameter optimization for fusion neutron yield from deuterium cluster explosion driven by intense femtosecond laser pulses *(8 pages)* . . . . . 043204
Hongyu Li, Jiansheng Liu, Guoquan Ni, Ruxin Li, and Zhizhan Xu

## PART B

**Atomic and molecular processes in external fields, including interactions with strong fields and short pulses**

Spin-orbit-interaction activated interchannel coupling in dipole and quadrupole photoionization *(8 pages)* . . . . 043401
S. Sunil Kumar, T. Banerjee, P. C. Deshmukh, and S. T. Manson

Magnus expansion for laser-matter interaction: Application to generic few-cycle laser pulses *(15 pages)* . . . . . 043402
Michael Klaiber, Darko Dimitrovski, and John S. Briggs

Trapping cold atoms using surface-grown carbon nanotubes *(11 pages)* . . . . . 043403
P. G. Petrov, S. Machluf, S. Younis, R. Macaluso, T. David, B. Hadad, Y. Japha, M. Keil, E. Joselevich, and R. Folman

Recombination of an atomic system in one, two, and three dimensions in the presence of an ultrastrong attosecond laser pulse: A comparison of results obtained using a Coulomb and a smoothed Coulomb potential *(13 pages)* . . . . . 043404
Tomasz Dziubak and Jacek Matulewski

Isotopic scaling in strong-field dissociation by few-cycle pulses *(5 pages)* . . . . . 043405
Lars Bojer Madsen

Polarized atoms in a far-off-resonance yttrium-aluminum-garnet-laser optical dipole trap *(4 pages)* . . . . . 043406
F. Fang, H. Wang, D. Feldbaum, D. J. Vieira, and X. Zhao

Strong-field phase-dependent molecular dissociation *(5 pages)* . . . . . 043407
Sarah R. Nichols, Thomas C. Weinacht, Tamás Rozgonyi, and Brett J. Pearson

Dicke-type energy level crossings in cavity-induced atom cooling: Another superradiant cooling *(14 pages)* . . . . . 043408
Masao Hirokawa

Two-center effects in one-photon single ionization of $H_2^+$, $H_2$, and $Li_2^+$ with circularly polarized light *(8 pages)* . . . . . 043409
J. Fernández, F. L. Yip, T. N. Rescigno, C. W. McCurdy, and F. Martín

Effect of realistic focal conditions on the strong-field ionization of helium *(9 pages)* . . . . . 043410
J. P. Paquette and J. L. Chaloupka

Probing the influence of channel coupling on the photoelectron angular distribution for the photodetachment from $Cu^-$ *(5 pages)* . . . . . 043411
G. Aravind, N. Bhargava Ram, A. K. Gupta, and E. Krishnakumar

Electric-field-induced resonances of highly excited molecules *(6 pages)* . . . . . 043412
Yasuyuki Kimura

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Macroscopic effects for quantum control of broadband isolated attosecond pulse generation with a two-color field *(8 pages)* . . . . . 043413
Pengfei Lan, Peixiang Lu, Qianguang Li, Fang Li, Weiyi Hong, and Qingbin Zhang

Effects of the carrier-envelope phase on atomic ionization by the pulse train in the multiphoton-ionization regime *(5 pages)* . . . . . 043414
Takashi Nakajima

Dissociation dynamics of $HD^+$ in intense femtosecond laser pulses by one-dimensional wave-packet propagation *(9 pages)* . . . . . 043415
Rangana Bhattacharya and S. S. Bhattacharyya

Fictitious-time wave-packet dynamics. I. Nondispersive wave packets in the quantum Coulomb problem *(11 pages)* . . . . . 043416
Tomaž Fabčič, Jörg Main, and Günter Wunner

Fictitious-time wave-packet dynamics. II. Hydrogen atom in external fields *(12 pages)* . . . . . 043417
Tomaž Fabčič, Jörg Main, and Günter Wunner

Solution of the Dirac equation for hydrogenlike systems exposed to intense electromagnetic pulses *(11 pages)* . . . . . 043418
Sølve Selstø, Eva Lindroth, and Jakob Bengtsson

Collective Rydberg excitations of an atomic gas confined in a ring lattice *(9 pages)* . . . . . 043419
B. Olmos, R. González-Férez, and I. Lesanovsky

Mesoscopic Rydberg ensembles: Beyond the pairwise-interaction approximation *(5 pages)* . . . . . 043420
K. C. Younge, A. Reinhard, T. Pohl, P. R. Berman, and G. Raithel

Above-threshold-ionization spectra from the core region of a time-dependent wave packet: An *ab initio* time-dependent approach *(8 pages)* . . . . . 043421
Dmitry A. Telnov and Shih-I Chu (朱時宜)

Probing condensate order in deep optical lattices *(13 pages)* . . . . . 043422
Kuei Sun, Courtney Lannert, and Smitha Vishveshwara

**Matter waves**

Bose-Hubbard ground state: Extended Bogoliubov and variational methods compared with time-evolving block decimation *(10 pages)* . . . . . 043601
Ippei Danshita and Pascal Naidon

Hartree-Fock-Bogoliubov theory of polarized Fermi systems *(9 pages)* . . . . . 043602
George Bertsch, Jacek Dobaczewski, Witold Nazarewicz, and Junchen Pei

Spinor Bose-Einstein condensate flow past an obstacle *(8 pages)* . . . . . 043603
A. S. Rodrigues, P. G. Kevrekidis, R. Carretero-González, D. J. Frantzeskakis, P. Schmelcher, T. J. Alexander, and Yu. S. Kivshar

Phase separation in atom-molecule mixtures near a Feshbach resonance *(7 pages)* . . . . . 043604
Xiao-Qiang Xu, Li-Hua Lu, and You-Quan Li

Atomic quasi-Bragg-diffraction in a magnetic field *(4 pages)* . . . . . 043605
K. F. E. M. Domen, M. A. H. M. Jansen, W. van Dijk, and K. A. H. van Leeuwen

Solitary vortices and gap solitons in rotating optical lattices *(11 pages)* . . . . . 043606
Hidetsugu Sakaguchi and Boris A. Malomed

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Dynamic and static density-density correlations in the one-dimensional Bose gas: Exact results and approximations *(7 pages)* . . . . . 043607
Alexander Yu. Cherny and Joachim Brand

Number fluctuation dynamics of a spin-1 atomic condensate *(8 pages)* . . . . . 043608
Q. Zhai, Lee Chang, Rong Lu, and L. You

Theory of preparation and relaxation of a *p*-orbital atomic Mott insulator *(26 pages)* . . . . . 043609
John H. Challis, S. M. Girvin, and L. I. Glazman

Truncated-Bloch-wave solitons in optical lattices *(5 pages)* . . . . . 043610
Jiandong Wang, Jianke Yang, Tristram J. Alexander, and Yuri S. Kivshar

Short-time dynamics of an ultracold Fermi gas in radio-frequency spectroscopy *(6 pages)* . . . . . 043611
Chun Kit Chung and C. K. Law

Suppression or enhancement of the Fulde-Ferrell-Larkin-Ovchinnikov order in a one-dimensional optical lattice with particle-correlated tunneling *(4 pages)* . . . . . 043612
B. Wang and L.-M. Duan

Generalized *ABCD* propagation for interacting atomic clouds *(14 pages)* . . . . . 043613
F. Impens and Ch. J. Bordé

Reentrance of Bose-Einstein condensation in spinor atomic gases in a magnetic field *(6 pages)* . . . . . 043614
Chengjun Tao, Zhirong Jiao, and Qiang Gu

Highly polarized Fermi gases: One-dimensional case *(7 pages)* . . . . . 043615
S. Giraud and R. Combescot

Spacetime analog of Bose-Einstein condensates: Bogoliubov–de Gennes formulation *(8 pages)* . . . . . 043616
Yasunari Kurita, Michikazu Kobayashi, Takao Morinari, Makoto Tsubota, and Hideki Ishihara

Quantum dynamics of instability-induced pulsations of a Bose-Einstein condensate in an optical lattice *(13 pages)* . . . . . 043617
Uttam Shrestha, Juha Javanainen, and Janne Ruostekoski

Observation of vortex formation in an oscillating trapped Bose-Einstein condensate *(5 pages)* . . . . . 043618
E. A. L. Henn, J. A. Seman, E. R. F. Ramos, M. Caracanhas, P. Castilho, E. P. Olímpio, G. Roati, D. V. Magalhães, K. M. F. Magalhães, and V. S. Bagnato

Nonlocal pair correlations in the one-dimensional Bose gas at finite temperature *(20 pages)* . . . . . 043619
P. Deuar, A. G. Sykes, D. M. Gangardt, M. J. Davis, P. D. Drummond, and K. V. Kheruntsyan

Dynamics of quantum vortices in a toroidal trap *(16 pages)* . . . . . 043620
Peter Mason and Natalia G. Berloff

Massless Dirac fermions in a square optical lattice *(7 pages)* . . . . . 043621
Jing-Min Hou, Wen-Xing Yang, and Xiong-Jun Liu

Chandrasekhar-Clogston limit and phase separation in Fermi mixtures at unitarity *(7 pages)* . . . . . 043622
I. Bausmerth, A. Recati, and S. Stringari

Excitations of Bose-Einstein condensates in a one-dimensional periodic potential *(4 pages)* . . . . . 043623
N. Fabbri, D. Clément, L. Fallani, C. Fort, M. Modugno, K. M. R. van der Stam, and M. Inguscio

Directional effects due to quantum statistics in dissociation of elongated molecular condensates *(6 pages)* . . . 043624
Magnus Ögren, C. M. Savage, and K. V. Kheruntsyan

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Comparative study of the finite-temperature thermodynamics of a unitary Fermi gas *(6 pages)* . . . . . 043625
Fang Qin and Ji-sheng Chen

Multiband superfluidity and superfluid–to–band-insulator transition of strongly interacting fermionic atoms in an optical lattice *(5 pages)* . . . . . 043626
A. A. Burkov and Arun Paramekanti

Jahn-Teller-induced Berry phase in spin-orbit-coupled Bose-Einstein condensates *(9 pages)* . . . . . 043627
Jonas Larson and Erik Sjöqvist

Decoherence in the collision of two Bose-Einstein condensates *(8 pages)* . . . . . 043628
Krzysztof Pawłowski and Kazimierz Rzążewski

Two-dimensional nonlinear vector states in Bose-Einstein condensates *(7 pages)* . . . . . 043629
A. I. Yakimenko, Yu. A. Zaliznyak, and V. M. Lashkin

Atom interferometry using Kapitza-Dirac scattering in a magnetic trap *(6 pages)* . . . . . 043630
R. E. Sapiro, R. Zhang, and G. Raithel

Amplification of fluctuations in a spinor Bose-Einstein condensate *(5 pages)* . . . . . 043631
S. R. Leslie, J. Guzman, M. Vengalattore, Jay D. Sau, Marvin L. Cohen, and D. M. Stamper-Kurn

All-optical imprinting of geometric phases onto matter waves *(5 pages)* . . . . . 043632
Qi Zhang, Jiangbin Gong, and C. H. Oh

Ground-state properties of hard-core anyons in one-dimensional optical lattices *(5 pages)* . . . . . 043633
Yajiang Hao, Yunbo Zhang, and Shu Chen

Atomic entanglement generation and detection via degenerate four-wave mixing of a Bose-Einstein condensate in an optical lattice *(11 pages)* . . . . . 043634
Andrew J. Ferris, Murray K. Olsen, and Matthew J. Davis

**Quantum optics, physics of lasers, nonlinear optics, classical optics**

Cavity QED characterization of many-body atomic states in double-well potentials: Role of dissipation *(7 pages)* . . . . . 043801
W. Chen and P. Meystre

Spatial and temporal characterization of a Bessel beam produced using a conical mirror *(5 pages)* . . . . . 043802
K. B. Kuntz, B. Braverman, S. H. Youn, M. Lobino, E. M. Pessina, and A. I. Lvovsky

Giant Lamb shift in a Kerr nonlinear blackbody *(6 pages)* . . . . . 043803
Miao Yin and Ze Cheng

Open quantum system approach to single-molecule spectroscopy *(17 pages)* . . . . . 043804
Adrián A. Budini

Semiclassical quantization of the one- and two-kink dark solitons *(15 pages)* . . . . . 043805
J. C. Martinez and M. B. A. Jalil

Carrier-envelope-phase-dependent effects of high-order harmonic generation in a strongly driven two-level atom *(6 pages)* . . . . . 043806
Pei Huang, Xiao-Tao Xie, Xinyou Lü, Jiahua Li, and Xiaoxue Yang

Dual control of slow light in reciprocal electromagnetically-induced-transparency conditions *(9 pages)* . . . . . 043807
Dariusz Dziczek and Stanisław Chwirot

Conditional preparation of arbitrary superpositions of atomic Dicke states *(9 pages)* . . . . . 043808
Karel Lemr and Jaromír Fiurášek

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Creating polarization singularities with an *N*-pinhole interferometer *(7 pages)* . . . . . 043809
Robert W. Schoonover and Taco D. Visser

Effect of spontaneously generated coherence on absorption in a V-type system: Investigation in dressed states *(5 pages)* . . . . . 043810
Chun-Liang Wang, Zhi-Hui Kang, Si-Cong Tian, Yun Jiang, and Jin-Yue Gao

Temporally shaping biphoton wave packets with periodically modulated driving fields *(5 pages)* . . . . . 043811
Shengwang Du, Jianming Wen, and Chinmay Belthangady

Spontaneous decay of a two-level atom near the left-handed slab *(9 pages)* . . . . . 043812
Jing-Ping Xu, Ya-Ping Yang, Qiang Lin, and Shi-Yao Zhu

Intracavity electromagnetically induced transparency in atoms around a nanofiber with a pair of Bragg grating mirrors *(8 pages)* . . . . . 043813
Fam Le Kien and K. Hakuta

Atom microscopy via two-photon spontaneous emission spectroscopy *(7 pages)* . . . . . 043814
Sajid Qamar, Jörg Evers, and M. Suhail Zubairy

Polarization-based light-atom quantum interface with an all-optical trap *(7 pages)* . . . . . 043815
M. Kubasik, M. Koschorreck, M. Napolitano, S. R. de Echaniz, H. Crepaz, J. Eschner, E. S. Polzik, and M. W. Mitchell

Modulation analysis of boundary-induced motion of optical solitary waves in a nematic liquid crystal *(8 pages)* . . . . . 043816
Alessandro Alberucci, Gaetano Assanto, Daniel Buccoliero, Anton S. Desyatnikov, Timothy R. Marchant, and Noel F. Smyth

Engineering of two-photon spatial quantum correlations behind a double slit *(15 pages)* . . . . . 043817
W. H. Peeters, J. J. Renema, and M. P. van Exter

Interplay of plasma-induced and fast thermal nonlinearities in a GaAs-based photonic crystal nanocavity *(9 pages)* . . . . . 043818
Alfredo de Rossi, Michele Lauritano, Sylvain Combrié, Quynh Vy Tran, and Chad Husko

Optical activity in diffraction from a planar array of achiral nanoparticles *(5 pages)* . . . . . 043819
S. N. Volkov, Ksenia Dolgaleva, Robert W. Boyd, Konstantins Jefimovs, Jari Turunen, Yuri Svirko, Brian K. Canfield, and Martti Kauranen

Generating highly squeezed hybrid Laguerre-Gauss modes in large-Fresnel-number degenerate optical parametric oscillators *(9 pages)* . . . . . 043820
Carlos Navarrete-Benlloch, Germán J. de Valcárcel, and Eugenio Roldán

Observation of double-charge discrete vortex solitons in hexagonal photonic lattices *(8 pages)* . . . . . 043821
Bernd Terhalle, Tobias Richter, Kody J. H. Law, Dennis Göries, Patrick Rose, Tristram J. Alexander, Panayotis G. Kevrekidis, Anton S. Desyatnikov, Wieslaw Krolikowski, Friedemann Kaiser, Cornelia Denz, and Yuri S. Kivshar

Spectral properties and modes of surface microcavities *(12 pages)* . . . . . 043822
R. C. Pennington, G. D'Alessandro, J. J. Baumberg, and M. Kaczmarek

Carrier-envelope phase dependence of the spectra of reflected few-cycle laser pulses in the presence of a static electric field *(6 pages)* . . . . . 043823
Chaojin Zhang, Weifeng Yang, Xiaohong Song, and Zhizhan Xu

Dipole nanolasers: A study of their quantum properties *(7 pages)* . . . . . 043824
A. S. Rosenthal and Talal Ghannam

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Spatial-state Stokes-operator squeezing and entanglement for optical beams *(6 pages)* . . . . . 043825
M. T. L. Hsu, W. P. Bowen, and P. K. Lam

Isolated attosecond pulse emission in the plateau region of high-order harmonics driven by a 7-fs 800-nm laser field *(5 pages)* . . . . . 043826
Candong Liu, Yinghui Zheng, Zhinan Zeng, Ruxin Li, and Zhizhan Xu

Dark-soliton stripes on a paraboloidal background in a bulk nonlinear medium *(8 pages)* . . . . . 043827
Xuesong Zhao, Lu Li, and Zhiyong Xu

Macroscopic generation of attosecond-pulse trains in strongly ionized media *(8 pages)* . . . . . 043828
V. Tosa, K. T. Kim, and C. H. Nam

Chirped-pulse oscillators: A unified standpoint *(10 pages)* . . . . . 043829
V. L. Kalashnikov and A. Apolonski

Quantum state measurements using multipixel photon detectors *(6 pages)* . . . . . 043830
I. Afek, A. Natan, O. Ambar, and Y. Silberberg

Generalized minimum-uncertainty squeezed states *(7 pages)* . . . . . 043831
E. Shchukin, Th. Kiesel, and W. Vogel

Optic Tamm states: The Bloch-wave-expansion method *(7 pages)* . . . . . 043832
Xiubao Kang, Wei Tan, Zhiguo Wang, and Hong Chen

Multiringed breathers and rotating breathers in strongly nonlocal nonlinear media under the off-waist incident condition *(9 pages)* . . . . . 043833
Daquan Lu and Wei Hu

Completeness of evanescent modes in layered dielectrics *(7 pages)* . . . . . 043834
Ana María Contreras Reyes and Claudia Eberlein

Parametric down-conversion from a wave-equation approach: Geometry and absolute brightness *(9 pages)* . . . . . 043835
Morgan W. Mitchell

Experimental verification of high spectral entanglement for pulsed waveguided spontaneous parametric down-conversion *(5 pages)* . . . . . 043836
Malte Avenhaus, Maria V. Chekhova, Leonid A. Krivitsky, Gerd Leuchs, and Christine Silberhorn

## BRIEF REPORTS

### Fundamental concepts

Confinement limit of Dirac particles in scalar one-dimensional potentials *(2 pages)* . . . . . 044101
R. G. Unanyan, J. Otterbach, and M. Fleischhauer

Improved implementation of the Alicki–Van Ryn nonclassicality test for a single particle using Si detectors *(3 pages)* . . . . . 044102
Giorgio Brida, Ivo Pietro Degiovanni, Marco Genovese, Fabrizio Piacentini, Valentina Schettini, Nicolas Gisin, Sergey V. Polyakov, and Alan Migdall

Influence of detector motion in Bell inequalities with entangled fermions *(4 pages)* . . . . . 044103
André G. S. Landulfo and George E. A. Matsas

Relevance of a random choice in tests of Bell inequalities with two atomic qubits *(4 pages)* . . . . . 044104
Emilio Santos

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

**Quantum information**

Wireless connection between Josephson qubits *(4 pages)* . . . . . 044301
Sergei Sergeenkov and Giacomo Rotoli

Quantum repeaters free of polarization disturbance and phase noise *(4 pages)* . . . . . 044302
Zhen-Qiang Yin, Yi-Bo Zhao, Yong Yang, Zheng-Fu Han, and Guang-Can Guo

Geometric phase of a quantum dot system in nonunitary evolution *(4 pages)* . . . . . 044303
Sun Yin and D. M. Tong

Quantum state transfer between distant nodes of a quantum network via adiabatic passage *(4 pages)* . . . . . 044304
Y. L. Zhou, Y. M. Wang, L. M. Liang, and C. Z. Li

Breakdown of the rotating-wave approximation in the description of entanglement of spin-anticorrelated states *(4 pages)* . . . . . 044305
Jun Jing, Zhi-Guo Lü, and Zbigniew Ficek

**Atomic and molecular structure and dynamics**

Binding two-loop vacuum-polarization corrections to the bound-electron $g$ factor *(4 pages)* . . . . . 044501
Ulrich D. Jentschura

Normalization of states for a quantum magnetic circular billiard *(4 pages)* . . . . . 044502
E. de Prunelé

**Atomic and molecular processes in external fields, including interactions with strong fields and short pulses**

Field-assisted bond stretching of CO in intense laser fields *(4 pages)* . . . . . 045401
Qingqing Liang, Chengyin Wu, Zhifeng Wu, Min Liu, Yongkai Deng, and Qihuang Gong

**Matter waves**

Coherent two-color photoassociation in a spinor-1 Bose-Einstein condensate: Single-spin versus mixed-spin cases *(4 pages)* . . . . . 045601
H. Jing, J. Fu, Z. Geng, and W.-M. Liu

Application of the Feshbach-resonance management to a tightly confined Bose-Einstein condensate *(4 pages)* . . . . . 045602
G. Filatrella, B. A. Malomed, and L. Salasnich

**Quantum optics, physics of lasers, nonlinear optics, classical optics**

Symmetric and asymmetric solitons in two-dimensional dual-core waveguides with a one-dimensional lattice *(4 pages)* . . . . . 045801
Lazar Gubeskys and Boris A. Malomed

**COMMENTS**

Comment on "Relevance of Bell's theorem as a signature of nonlocality: Case of classical angular momentum distributions" *(2 pages)* . . . . . 046101
Ten Yong Tung

*(Continued)*

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.

PHYSICAL REVIEW A THIRD SERIES, VOLUME 79, NUMBER 4 APRIL 2009

Reply to "Comment on 'Relevance of Bell's theorem as a signature of nonlocality: Case of classical angular momentum distributions' " *(2 pages)* . . . . . 046102
A. Matzkin

## ERRATA

Erratum: Dark solitons and their head-on collisions in Bose-Einstein condensates [Phys. Rev. A **64**, 013617 (2001)] *(1 page)* . . . . . 049901(E)
Guoxiang Huang, Manuel G. Velarde, and Valeri A. Makarov

Erratum: Geometric phase and quantum phase transition in an inhomogeneous periodic *XY* spin-$\frac{1}{2}$ model [Phys. Rev. A **79**, 022116 (2009)] *(1 page)* . . . . . 049902(E)
Yu-Quan Ma and Shu Chen

Erratum: Preparation and characterization of arbitrary states of four-dimensional qudits based on biphotons [Phys. Rev. A **78**, 042321 (2008)] *(1 page)* . . . . . 049903(E)
So-Young Baek, Stanislav S. Straupe, Alexander P. Shurupov, Sergei P. Kulik, and Yoon-Ho Kim

Selected for a Viewpoint in *Physics*. Please visit http://physics.aps.org/.