

# PHYSICAL REVIEW A

## ATOMIC, MOLECULAR, AND OPTICAL PHYSICS

### Editor

**BERND CRISEMAN**  
(University of Oregon)

### Associate Editors

**LEE A. COLLINS**  
(Los Alamos National Laboratory)

**JULIO GEA-BANACLOCHE**  
(University of Arkansas)

**MARGARET MALLOY**  
(APS Editorial Office)

**LORENZO NARDUCCI**  
(Drexel University)

**STEPHEN J. SMITH**  
(University of Colorado)

### Assistant Editors

**MARGARET FOSTER**  
**VALERIE L. MILLER**  
**JOANNA POPADIUK**

*Assistant to the Editors*  
**JILL M. GARGANO**

### APS Editorial Office

1 Research Road, Box 9000  
Ridge, NY 11961-9000  
Phone: (631) 591-4010  
Fax: (631) 591-4141  
Email: pra@aps.org  
Web: <http://publish.aps.org/>  
Submissions: [pratex@aps.org](mailto:pratex@aps.org) or  
<http://publish.aps.org/ESUB/>

### EDITORIAL BOARD

*Term ending 31 December 2002*

|                 |                                     |
|-----------------|-------------------------------------|
| I. CIRAC        | Quantum Information, Quantum Optics |
| J. D. FRANSON   | Quantum Measurement                 |
| C. MACCHIAVELLO | Quantum Information                 |
| S. STENHOLM     | Quantum Optics                      |
| W. C. STWALLEY  | Atomic and Molecular Physics        |

*Term ending 31 December 2003*

|                 |                                     |
|-----------------|-------------------------------------|
| L. J. CURTIS    | Atomic Physics                      |
| J. DOWLING      | Quantum Optics, Quantum Information |
| G. W. F. DRAKE  | Atomic Theory                       |
| M. HILLERY      | Quantum Information                 |
| A. MAQUET       | Atomic Physics                      |
| M. PESHKIN      | Theoretical Physics                 |
| J. SHERTZER     | Atomic Theory                       |
| H. T. C. STOOFF | Matter Waves                        |

*Term ending 31 December 2004*

|                      |                     |
|----------------------|---------------------|
| S. M. BARNETT        | Quantum Optics      |
| W. BECKER            | Atomic Physics      |
| I. BIALYNICKI-BIRULA | Theoretical Physics |
| D. DiVINCENZO        | Quantum Information |
| C. H. GREENE         | Atomic Theory       |
| W. R. JOHNSON        | Atomic Theory       |
| A. OREL              | Molecular Theory    |
| L. OROZCO            | Quantum Optics      |
| A. PERES             | Quantum Theory      |
| S. ROLSTON           | Matter Waves        |
| H. WISEMAN           | Quantum Theory      |

**The American Physical Society**  
One Physics Ellipse  
College Park, MD 20740-3844

|                          |                     |
|--------------------------|---------------------|
| <i>President</i>         | WILLIAM F. BRINKMAN |
| <i>President-Elect</i>   | MYRIAM P. SARACHIK  |
| <i>Vice-President</i>    | HELEN R. QUINN      |
| <i>Editor-in-Chief</i>   | MARTIN BLUME        |
| <i>Treasurer</i>         |                     |
| <i>and Publisher</i>     | THOMAS J. McILRATH  |
| <i>Executive Officer</i> | JUDY R. FRANZ       |

Member Subscriptions:

**APS Membership Department**  
One Physics Ellipse  
College Park, MD 20740-3844  
Phone: (301) 209-3280  
Fax: (301) 209-0867  
Email: [membership@aps.org](mailto:membership@aps.org)

Nonmember Subscriptions:

**APS Subscription Services**  
Suite 1N01  
2 Huntington Quadrangle  
Melville, NY 11747-4502  
Phone: (516) 576-2270, (800) 344-6902  
Fax: (516) 576-9704  
Email: [subs@aps.org](mailto:subs@aps.org)

*Production and distribution by*

**American Institute of Physics**  
Suite 1N01  
2 Huntington Quadrangle  
Melville, NY 11747-4502  
Phone: (516) 576-2200  
Fax: (516) 576-2643  
Email: [pra@aip.org](mailto:pra@aip.org)

**Manuscripts** may be submitted electronically if in appropriate format (see <http://publish.aps.org/ESUB/> or inquire at [pratex@aps.org](mailto:pratex@aps.org)). Alternatively, send four copies to the Editorial Office. Submission is a representation that the manuscript has not been published previously and is not currently under consideration for publication elsewhere. A signed APS **copyright-transfer** form (effective only on acceptance for publication) must be provided; the form is available on our Web server and appears at the end of the 3 December 2001 issue of *Physical Review Letters*. Information for contributors may be found on our Web server or in the January and July issues.

To help defray editorial and production expenses, authors of published articles are requested to pay a **publication charge** of \$95 per article plus \$95 per journal page. Publication charges are not requested for properly prepared electronic submissions. Acceptable formats are REVTeX (preferred), LaTeX, Harvmac, Plain TeX; PostScript figures. **Reprints** are offered for sale to authors.

For information about **subscription prices** and about the **online version** of the journal, see our Web server, or inquire at [assocpub@aps.org](mailto:assocpub@aps.org). **Member** inquiries regarding **subscriptions**, renewals, address changes, missing or damaged copies, microfilm, and single-copy orders should be addressed to the APS Membership Department. **Nonmembers** should address subscription inquiries to APS Subscription Services. For address changes please send both old and new addresses, and, if possible, include an address stencil imprint from the mailing wrapper of a recent issue; allow six weeks advance notice.

### Copyright 2002 by The American Physical Society

**Permission** to quote excerpts or to reprint any figures or tables should be obtained directly from an author. The American Physical Society for its part hereby grants permission to quote excerpts and reprint figures and/or tables from its journals with acknowledgment of the sources. **Individual** teachers, students, researchers, and libraries in nonprofit institutions acting for them are permitted to make hard copies of articles for use in teaching or research, provided such copies are not sold. **Copying of articles for sale** by document delivery services or suppliers, or beyond the free copying allowed above, is permitted against payment of a copying fee. The current copying fee is \$20.00, per article, per copy. Express permission of APS is not required, except for purposes stated below, provided that the fee is paid through the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923. Contact the CCC for information on how to report copying and remit payments. **Reproduction** in a reprint collection, or for advertising or promotional purposes, or republication in any form requires permission of one of the authors and a license from APS. Such a license must be sought from Barbara Hicks, Associate Publisher, The American Physical Society, One Physics Ellipse, College Park, MD 20740-3844. Permission from the author must be sought and obtained from him or her directly.

**Physical Review A** (ISSN: 1050-2947; CODEN PLRAAN; printed in USA) is published monthly (on the 1<sup>st</sup> of each month) by The American Physical Society through the American Institute of Physics.

**POSTMASTER:** Send address changes to Physical Review A, APS Subscription Services, Suite 1N01, 2 Huntington Quadrangle, Melville, NY 11747-4502. The 2002 print + online subscription price is \$1950 Academic Base; \$2145 Carnegie Doctoral/Equivalent; \$2345 Carnegie Research/Equivalent/Corporate & Government. Periodicals postage rates are paid at Huntington Station, NY, and additional mailing offices.