PHYSICAL REVIEW LETTERS

Providing rapid publication of short reports of important fundamental research, with coverage of major advances in all aspects of physics and of developments with significant consequences across subdisciplines.

Editors

HUGUES CHATÉ
ROBERT GARISTO
SAMINDRANATH MITRA
REINHARDT B. SCHUHMANN

Associate Editors

ABHISHEK AGARWAL
ROCIO CORTES
SERENA DALENA
OLGA DUDKO
KEVIN DUSLING
SONJA GRONDALSKI
DONAVAN HALL
SAAD E. HEBBOUL
FRANK NARDUCCI
STOJAN REBIC
JANE THROWE
DANIEL UCKO
DENIZ VAN HEIJNSBERGEN
ALESSANDRO VILLAR
RAPHAEL VOITURIEZ
MU WANG
KYLE WELCH

Assistant Editors

VALERIE L. MILLER
JOHN RIPKA

Editorial Board ***(Divisional Associate Editors)***

Astrophysics
J. BEACOM, A. KOSOWSKY, J. LATTIMER

Atomic, Molecular, and Optical Physics
M. DAVIS, R. DÖRNER, M.D. HAVEY, N. LUTKENHAUS, G. MORIGI, H. RITSCH, J. RUOSTEKOSKI, F. SCHMIDT-KALER, W. ZHANG

Biological Physics
H. LEVINE, J.W. SHAEVITZ, L. TSIMRING

Chemical Physics
K. MORGENSTERN, A. TKATCHENKO

Condensed Matter Physics
J.L. BARRAT, K. BEHNIA, F.J. BERMEJO, A. BLACK-SCHAFFER, A.L. CHERNYSHEV, R. CLAESSEN, P. DAI, D.L. FENG, M. FRANZ, F.J. GARCIA-VIDAL, H. GLYDE, M.B. HASTINGS, M.W. HAVERKORT, T. HEINZEL, M.I. KATSNELSON, C.H. MARROWS A. MOREO, E. PAVARINI, S. RAO, H.R. SCHOBER, S.H. SIMON, O.V. TCHERNYSHYOV, D. VANDEMBROUCQ, B.O. WELLS, K. YANG

Fluid Dynamics
J. DE BRUYN, J. EGGERS, G. FALKOVICH, R.L. LEHENY

Gravitational Physics
A. ASHTEKAR, E. BERTI

Laser Science
S.T. CUNDIFF, P.D. DRUMMOND, E. GIACOBINO, A. MAQUET, G-L. OPPO

Materials Physics
J. HLINKA, F. LIU

Nuclear Physics
C.N. DAVIDS, J. KOLATA, R. LIOTTA, C. MANUEL, G. MOORE, J. VELKOVSKA

Particles and Fields
A. DE GOUVEA, T.A. DEGRAND, R. GOPAKUMAR, V. LUTH, W. VOGELSANG, C.E.M. WAGNER

Physics of Beams
A. WOLSKI

Plasma Physics
J. CHITTENDEN, J.S. DEGRASSIE M.L. GOLDSTEIN, G. MORALES, V. TIKHONCHUK

Polymer Physics
M.W. MATSEN, P. OLMSTED, G. REITER

Foundations of Quantum Mechanics
C. MACCHIAVELLO

Quantum Information
J. EISERT, A.V. SERGIENKO, L. VIOLA

Statistical Physics and Nonlinear Dynamics
K. DANIELS, R. GOLESTANIAN, V. HAKIM, Y. KAFRI, R. KLAGES, Y. MORENO, S. REDNER, P. REIMANN, K. SNEPPEN

American Physical Society

President DAVID J. GROSS
Speaker of Council JOHN RUMBLE
Chief Executive Officer KATE P. KIRBY
Editor in Chief MICHAEL THOENNESSEN
Publisher MATTHEW SALTER
Chief Information Officer MARK D. DOYLE
Chief Financial Officer MARGARET BANDERA
Deputy Executive Officer and Chief Operating Officer JAMES TAYLOR
Chief Government Affairs Officer FRANCIS SLAKEY

One Physics Ellipse
College Park, MD 20740-3844

APS Editorial Office

Directors
Editorial DANIEL T. KULP
Journal Operations CHRISTINE M. GIACCONE

1 Research Road
Ridge, NY 11961-2701
Phone: (631) 591-4060
Email: prl@aps.org
Web: https://journals.aps.org/
Submissions:
https://authors.aps.org/Submissions/

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

Institutional Subscriptions:

APS Subscription Services
P.O. Box 41
Annapolis Junction, MD 20701
Toll free: (888) 339-9655
Phone: (301) 617-7809 Email: subs@aps.org

Letters intended for this journal must be short and self-contained. Information for Contributors and a description of editorial Policies and Practices can be found at http://journals.aps.org/prl/authors.

Manuscripts should be **submitted** electronically in acceptable format (see http://authors.aps.org/Submissions/). Submission is a repretation that the manuscript has not been published previously and is not currently under consideration for publication elsewhere. An executed APS **copyright-transfer** form (effective only on acceptance for publication) must be provided.

To help defray editorial and production expenses, authors of published Letters are expected to pay a **publication charge** of $800 ($295 for a Comment or Reply). Charges are higher ($995 for a Letter, $370 for a Comment or Reply) for those which are not submitted in an acceptable electronic format. Acceptable formats are REVTEX (preferred), LATEX, plain TEX, MS Word; PostScript figures (preferred). **Reprints** are offered for sale to corresponding authors.

For additional information regarding the online version of this journal, please visit: http://journals.aps.org/prl/. Institutional subscribers requesting address changes, filing claims, or requesting additional information, please contact the APS Subscription Services at subs@aps.org. Member subscribers requiring changes, claims or additional information should contact the APS Membership Department at membership@aps.org.

Copyright © 2019 American Physical Society. All rights reserved.

Physical Review Letters™ is a trademark of the American Physical Society, registered in the United States, Canada, European Union and Japan.

Rights and Permissions: http://journals.aps.org/copyrightFAQ.html

Copying: No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the written permission of the publisher, except as stated below. Single copies of individual articles may be made for private use or research. Authorization is given to copy articles beyond the use permitted by Sections 107 and 108 of the U.S. Copyright Law, provided the copying fee of $25.00 per copy per article is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA.

Reproduction of an entire article in a reprint collection, or for advertising or promotional purposes, or republication in any form requires permission from APS. Permission must be sought via Aptara's SciPris™ platform. To request permission to republish, refer to the Reuse and Permissions link that can be found on each APS article page and provide the requested information.

Other Use: Permission is granted to quote from the journal with the customary acknowledgment of the source. Permission must be sought using Aptara's SciPris™ platform. To request permission to reproduce a figure, table, or excerpt of an article refer to the Reuse and Permissions link that can be found on each APS article page and provide the requested information. Authorization for private use or research does not extend to systematic or multiple reproduction, to copying for promotional purposes, to distribution in any format, or to republication in any form. In all such cases, specific permission from APS must be obtained.

Physical Review Letters **[ISSN: 0031-9007 (print), 1079-7114 (online); CODEN PRLTAO; printed in USA] is published weekly by the American Physical Society, 1 Research Road, Ridge, NY 11961-2701.**