

# PHYSICAL REVIEW E

covering statistical, nonlinear, biological, and soft matter physics

## EDITORIAL BOARD

*Term ending 31 December 2019*

*Editor*  
**ELI BEN-NAIM**  
(Los Alamos National Laboratory)

*Managing Editor*  
**DIRK JAN BUKMAN**  
(APS Editorial Office)

*Associate Editors*  
**ALEX ARENAS**  
(Universitat Rovira i Virgili)  
**SERENA BRADDE**  
(APS Editorial Office)  
**RALF BUNDSCHUH**  
(The Ohio State University)  
**RONALD DICKMAN**  
(Universidade Federal de Minas Gerais)

**BRUNO ECKHARDT**  
(Philipps-Universität Marburg)

**ANTAL JÁKLI**  
(Kent State University)

**BRANT M. JOHNSON**  
(Brookhaven National Laboratory)  
**JUAN-JOSÉ LIÉTOR-SANTOS**  
(APS Editorial Office)

**JULIAN D. MAYNARD**  
(Pennsylvania State University)

**THOMAS PATTARD**  
(APS Editorial Office)

**ANTONIO POLITI**  
(University of Aberdeen)

**ALEXANDER WAGNER**  
(North Dakota State University)

*Senior Assistant Editors*  
**MARGARET FOSTER**  
**JILL M. GARGANO**

*Assistant Editor*  
**KATIUSCIA CASSEMIRO**  
*Senior Editorial Assistant*  
**TERRE ARENA**

|                  |                                               |
|------------------|-----------------------------------------------|
| F. BORGONOV      | Classical and Quantum Chaos                   |
| E. S. C. CHING   | Turbulence                                    |
| S. CILIBERTO     | Nonequilibrium Systems, Fluid Mechanics       |
| J. P. GLEESON    | Complex Networks, Stochastic Processes        |
| S. GRANICK       | Soft and Living Matter                        |
| I. H. HUTCHINSON | Plasma Physics                                |
| A. KUDROLLI      | Granular Matter, Nonlinear Dynamics           |
| F. LEYVAZ        | Statistical Physics                           |
| M. P. MARDER     | Fracture and Friction, Pattern Formation      |
| S. SUCCI         | Computational Fluid Dynamics                  |
| U. C. TÄUBER     | Statistical Physics, Biological Physics       |
| J. M. YEOMANS    | Soft and Active Matter, Computational Physics |

*Term ending 31 December 2020*

|               |                                            |
|---------------|--------------------------------------------|
| E.G. ALTMANN  | Nonlinear Dynamics, Chaos, Complex Systems |
| A. BUKA       | Liquid Crystals, Pattern Formation         |
| D. GAUTHIER   | Quantum Chaos                              |
| D. GRIER      | Colloids, Complex Fluids                   |
| W. HORSTHEMKE | Stochastic Physics, Chemical Kinetics      |
| J. KERTESZ    | Networks, Complex Systems                  |
| U. SCHWARZ    | Soft Matter and Biological Physics         |
| U. SEIFERT    | Statistical Physics, Thermodynamics        |
| L. TUCKERMAN  | Fluid Dynamics                             |
| J. YANG       | Solitons, Nonlinear Waves                  |
| L. ZDEBOROVA  | Disordered Systems, Machine Learning       |

*Term ending 31 December 2021*

|                   |                                                                               |
|-------------------|-------------------------------------------------------------------------------|
| S. BOETTCHER      | Statistical Physics, Complex Systems                                          |
| H. DIAMANT        | Solid Mechanics, Colloids, Membranes                                          |
| L. R. EVANGELISTA | Liquid Crystals, Complex Fluids                                               |
| S. FAUVE          | Fluid Dynamics, Nonlinear Dynamics                                            |
| H. HAYAKAWA       | Granular Materials, Kinetic Theory, Nonequilibrium Statistical Mechanics      |
| S. KLUMPP         | Biological Physics                                                            |
| Y. LEVIN          | Statistical Physics, Complex Fluids                                           |
| U. PARLITZ        | Nonlinear Dynamics, Chaos                                                     |
| F. RADICCHI       | Complex Networks, Data Analytics                                              |
| B. SPAGNOLO       | Stochastic Dynamics, Nonequilibrium Statistical Mechanics, Biological Physics |
| D. VAN DER MEER   | Granular Matter, Physics of Fluids                                            |
| I. Y. DODIN       | Plasma Physics                                                                |

## American Physical Society

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

One Physics Ellipse  
College Park, MD 20740-3844

## APS Editorial Office

### Directors

|                           |                       |
|---------------------------|-----------------------|
| <i>Editorial</i>          | DANIEL T. KULP        |
| <i>Journal Operations</i> | CHRISTINE M. GIACCONE |

1 Research Road  
Ridge, NY 11961-2701  
Phone: (631) 591-4050

Email: [pre@aps.org](mailto:pre@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](mailto: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](mailto:subs@aps.org)

**Manuscripts** should be submitted electronically in acceptable format (see <http://authors.aps.org/Submissions/>). Submission is a representation that the manuscript has not been published previously and is not currently under consideration for publication elsewhere. An executed APS **copyright-transfer** form must be provided (effective only on acceptance for publication). Information for Contributors and a description of editorial Policies and Practices can be found at <http://journals.aps.org/pre/authors>.

To help defray editorial and production expenses, authors of manuscripts which are not submitted in acceptable electronic format are expected to pay a **publication charge** of \$1620/article, \$1010/Rapid Communication, \$370/Comment or Reply. Acceptable formats are REV<sub>T</sub>EX (preferred), L<sub>T</sub>EX, plain T<sub>E</sub>X; MS Word; PostScript figures (preferred). **Reprints** are offered for sale to authors.

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

Copyright © 2019 American Physical Society. All rights reserved.

*Physical Review E*<sup>TM</sup> 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<sup>TM</sup> 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<sup>TM</sup> 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 E* [ISSN: 2470-0045 (print), 2470-0053 (online); CODEN PLEEE8; printed in USA] is published monthly by the American Physical Society, 1 Research Road, Ridge, NY 11961-2701.