

Probability, Geometry and Integrable Systems

For Henry McKean's Seventy-Fifth Birthday

Edited by

Mark Pinsky
Björn Birnir

Mark Pinsky
Department of Mathematics
Northwestern University
Evanston, IL 60208

Björn Birnir
Center for Complex and Nonlinear Science
and Department of Mathematics
University of California, Santa Barbara
Santa Barbara, CA 93106

Silvio Levy (*Series Editor*)
Mathematical Sciences Research Institute
17 Gauss Way, Berkeley, CA 94720
levy@msri.org

The Mathematical Sciences Research Institute wishes to acknowledge support by the National Science Foundation and the *Pacific Journal of Mathematics* for the publication of this series.

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi

Cambridge University Press
32 Avenue of the Americas, New York, NY 10013-2473, USA
www.cambridge.org

Information on this title: www.cambridge.org/9780521895279

© Mathematical Sciences Research Institute 2008

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2008

Printed in the United States of America

A catalog record for this book is available from the British Library.

Library of Congress Cataloging in Publication data

Probability, geometry, and integrable systems / edited by Mark Pinsky, Björn Birnir.

p. cm. – (Mathematical Sciences Research Institute publications ; 55)

“For Henry McKean’s Seventy-Fifth Birthday.” Includes bibliographical references and index.

ISBN 978-0-521-89527-9 (hardback)

1. Probabilities. 2. Geometry, Differential. 3. Hamiltonian systems. I. Pinsky, Mark A., 1940- II. Birnir, Björn. III. McKean, Henry P.

QA273.P79536 2008

519.2-dc22

2007052192

ISBN 978-0-521-89527-9 hardcover

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party Internet Web sites referred to in this publication and does not guarantee that any content on such Web sites is, or will remain, accurate or appropriate.

Contents

Preface	ix
Tribute to Henry McKean	xv
Direct and inverse problems for systems of differential equations DAMIR AROV AND HARRY DYM	1
Turbulence of a unidirectional flow BJORN BIRNIR	29
Riemann–Hilbert problem in the inverse scattering for the Camassa–Holm equation on the line ANNE BOUTET DE MONVEL AND DMITRY SHEPELSKY	53
The Riccati map in random Schrödinger and matrix theory SANTIAGO CAMBRONERO, JOSÉ RAMÍREZ AND BRIAN RIDER	77
SLE ₆ and CLE ₆ from critical percolation FEDERICO CAMIA AND CHARLES M. NEWMAN	103
Global optimization, the Gaussian ensemble and universal ensemble equivalence MARIUS COSTENIUC, RICHARD S. ELLIS, HUGO TOUCHETTE AND BRUCE TURKINGTON	131
Stochastic evolution of inviscid Burger fluid ANA BELA CRUZEIRO AND PAUL MALLIAVIN	167
A quick derivation of the loop equations for random matrices N. M. ERCOLANI AND K. D. T-R MCLAUGHLIN	185
Singular solutions for geodesic flows of Vlasov moments J. GIBBONS, D. D. HOLM AND C. TRONCI	199
Reality problems in soliton theory PETR G. GRINEVICH AND SERGEI P. NOVIKOV	221
Random walks and orthogonal polynomials; some challenges F. ALBERTO GRÜNBAUM	241
Integration of pair flows of the Camassa–Holm hierarchy ENRIQUE LOUBET	261
Landen survey DANTE V. MANNA AND VICTOR H. MOLL	287

Lines on abelian varieties	321
EMMA PREVIATO	
Integrable models of waves in shallow water	345
HARVEY SEGUR	
Nonintersecting Brownian motions, integrable systems and orthogonal polynomials	373
PIERRE VAN MOERBEKE	
Homogenization of random Hamilton–Jacobi–Bellman equations	397
S. R. SRINIVASA VARADHAN	