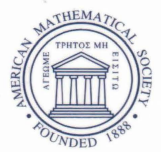
CONTEMPORARY MATHEMATICS

412

Recent Advances in Differential Equations and Mathematical Physics

UAB International Conference on Differential Equations and Mathematical Physics
March 29–April 2, 2005
University of Alabama at Birmingham

Nikolai Chernov
Yulia Karpeshina
Ian W. Knowles
Roger T. Lewis
Rudi Weikard
Editors



American Mathematical Society

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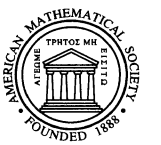

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Preface

This volume forms a partial record of lectures given in the 10th International Conference on Differential Equations and Mathematical Physics held on the campus of the University of Alabama at Birmingham from March 29 to April 2, 2005. As with previous events in this series, which now dates back nearly a quarter century to 1981, the tone for the conference was set by our distinguished group of plenary speakers, and this carried over into the session lectures, which ranged over a wide variety of subjects loosely connected under the twin umbrellas of mathematical physics and differential equations. As always the conference was truly international in character, with attendees travelling to Birmingham from parts of the United States and 30 foreign countries, including Algeria, Austria, Bangladesh, Brazil, Canada, Chile, China, the Czech Republic, Egypt, Finland, Germany, India, Israel, Italy, Japan, Mexico, Muscat, New Zealand, Oman, the Phillipines, Poland, Russia, Serbia-Montenegro, South Africa, Sweden, Tunisia, Turkey, Ukraine, the UK, and Uzbekistan.

An event of this magnitude would not be possible without the assistance of a number of generous benefactors. On behalf of the participants, the conference organizers gratefully acknowledge the continuing financial support provided by the United States National Science Foundation, this time under grant number DMS-0455211; the UAB Department of Mathematics; and the Alabama Alliance for Minority Participation. We are also indebted to faculty and students in the UAB Department of Mathematics for generous gifts of their time and energy spent taking care of the the participants both during the days and at the various festivities arranged in the evenings after the formal lectures were over.

Nikolai Chernov
Yulia Karpeshina
Ian Knowles
Roger Lewis
Rudi Weikard

List of Plenary Speakers

Luis Caffarelli
University of Texas at Austin

Giovanni Gallavotti
University of Rome La Sapienza

Elliott Lieb
Princeton University

Thomas Spencer
Institute for Advanced Study

Lloyd N. Trefethen
Oxford University

Gunther Uhlmann
University of Washington

Andras Vásy
Massachusetts Institute of Technology

Lai-Sang Young
Courant Institute

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Alexandria University, Egypt
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Univ. of Missouri-Columbia, USA
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MAXIM ZYSKIN
University of Bristol, UK
Harmonic maps from polyhedra to sphere with tangent boundary conditions on faces

This book brings together both new material and recent surveys on some topics in differential equations that are either directly relevant to, or closely associated with, mathematical physics.

Its topics include asymptotic formulas for the ground-state energy of fermionic gas, renormalization ideas in quantum field theory from perturbations of the free Hamiltonian on the circle, J-selfadjoint Dirac operators, spectral theory of Schrödinger operators, inverse problems, isoperimetric inequalities in quantum mechanics, Hardy inequalities, and non-adiabatic transitions.

Excellent survey articles on Dirichlet-Neumann inverse problems on manifolds (by Uhlmann), numerical investigations associated with Laplacian eigenvalues on planar regions (by Trefethen), Snell's law and propagation of singularities in the wave equation (by Vasy), and random operators on tree graphs (by Aizenmann) make this book interesting and valuable for graduate students, young mathematicians, and physicists alike.

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