CONTEMPORARY MATHEMATICS

741

Analytic Trends in Mathematical Physics

Arizona School of
Analysis and Mathematical Physics
March 5–9, 2018
University of Arizona, Tucson, Arizona

Houssam Abdul-Rahman
Robert Sims
Amanda Young
Editors

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Preface

Successful researchers in mathematical physics often possess an informed exposure to the tools of mathematics and intuition derived from the methods of physics. A main goal of the Arizona School of Analysis and Mathematical Physics was to provide an environment where junior researchers could further develop in these directions. We organized speakers who would introduce current topics of exciting research that are both influenced by physical intuition and require the use of cutting-edge analytic techniques. Four mini-courses were designed to rigorously develop these important topics and illustrate how theory is used in problem solving.

Given the success of the previous Arizona schools in 2009, 2010, and 2012, we were encouraged to continue this tradition by organizing another Arizona School of Analysis and Mathematical Physics, which took place at the University of Arizona from March 5–9, 2018. Mini-courses comprised of four one-hour lectures were given by Sven Bachmann (Adiabatic Dynamics and Linear Response Theory for Many-Body Quantum Systems), Fernando Brandão (Entanglement Theory), Jan-Philip Solovej (Quasi-Free Variational Models for Bosons and Fermions), and Günter Stolz (Disordered Quantum Spin Chains). A number of senior participants (Bruno Nachtergaele, Jeff Schenker, Anna Vershynina, and Mei Yin) gave lectures on topics related to the main focus of the mini-courses, and a large fraction of the junior participants also gave short talks on their current research endeavors. In all, the diversity of participation was a testament to the enthusiasm this rich field generates.

The works in this volume reflect recent progress and innovative techniques developed within mathematical physics. New results investigating spectral gaps are contained in the article by Abdul-Rahman, Lemm, Lucia, Nachtergaele, and Young as well as the one by Lemm. Recent applications exploring quantum dynamics can be found in the articles by Bachmann, Bols, De Roeck, and Fraas and also by Bachmann, De Roeck, and Fraas. Perspectives from the theory of Schrödinger operators motivate the articles by Fischbacher and by Latushkin and Sukhtaiev. Probabilistic applications to random models inspired the articles by DeMuse and Yin, by Saenz, and by Stolz. The works by Bachmann, De Roeck, and Fraas and by Stolz form detailed lecture notes for two of the school's mini-courses. Moreover, the work by Abdul-Rahman, Lemm, Lucia, Nachtergaele, and Young is the product of discussions that emerged during a follow-up meeting to this Arizona School.

We would like to give our thanks to the people and organizations that helped us with this school. Our local organizers Alejandra Gaona, David Gonzalez, and

Aubrey Mouradian were instrumental in all aspects concerning coordination. Without them, none of this would have been possible. The bulk of the financial support for this school was provided by the National Science Foundation (grant DMS-1800724) to which we are extremely grateful. We also happily acknowledge additional support from the American Institute of Physics as well as crucial matching funds from the Department of Mathematics and the College of Science at the University of Arizona. These contributions were not only appreciated but also immensely important. Finally, our heart-felt thanks goes to all the lecturers, participants, and authors of the articles in this proceedings. Your contributions have made this school what it is: a great success!

June 2019

Houssam Abdul-Rahman, Robert Sims, and Amanda Young

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This volume contains the proceedings of the Arizona School of Analysis and Mathematical Physics, held from March 5–9, 2018, at the University of Arizona, Tucson, Arizona.

A main goal of this school was to introduce graduate students and postdocs to exciting topics of current research that are both influenced by physical intuition and require the use of cutting-edge mathematics.

The articles in this volume reflect recent progress and innovative techniques developed within mathematical physics. Two works investigate spectral gaps of quantum spin systems. Specifically, Abdul-Rahman, Lemm, Lucia, Nachtergaele, and Young consider decorated AKLT models, and Lemm demonstrates a finite-size criterion for D-dimensional models. Bachmann, De Roeck, and Fraas summarize a recent proof of the adiabatic theorem, while Bachmann, Bols, De Roeck, and Fraas discuss linear response for interacting Hall insulators. Models on general graphs are the topic of the articles by Fischbacher, on higher spin XXZ, and by Latushkin and Sukhtaiev, on an index theorem for Schrödinger operators. Probabilistic applications are the focus of the articles by DeMuse and Yin, on exponential random graphs, by Saenz, on KPZ universality, and by Stolz, on disordered quantum spin chains.

In all, the diversity represented here is a testament to the enthusiasm this rich field of mathematical physics generates.

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