PREFACE

Renormalization Group 2005

This special issue of *Journal of Physics A: Mathematical and General* is a collection of articles dealing with the application of renormalization group methods to a wide range of problems in physics. Most articles are based on contributions presented at the 6th International Conference, Renormalization Group 2005 (RG 2005), held at the University of Helsinki from 30 August to 3 September 2005. This was the sixth of a series of conferences on this topic, the first three of which took place in 1986, 1991 and 1996 at the Joint Institute for Nuclear Research in Dubna, Russia. The fourth (RG99) was held in 1999 in Taxco, Mexico, and the fifth (RG02) in 2002 in Tatranska Štrba, Slovakia.

During the second half of the 20th century a number of important and very successful new paradigms such as scale-dependent ('running') coupling constants, scaling, and universality became firmly established in physics. To a large extent, these advances were due to the development of renormalization group ideas and their successful implementation as powerful calculational schemes to tackle problems with many length scales. While the concept of the renormalization group had originally been introduced in elementary particle physics, its modern form eventually emerged from the study of problems in condensed matter physics, such as critical phenomena and the Kondo effect. This in turn has significantly reshaped our understanding of field theories in high energy physics, and produced powerful computational tools for dealing with difficult many-length-scale problems in distinct fields of physics, ranging from elementary particle and condensed matter physics to hydrodynamic turbulence and growth phenomena in nonequilibrium physics. The history of the renormalization group, characterized by frequent exchanges of ideas between elementary particle and condensed matter physics, bears testimony to the enormous benefits to which such exchanges can lead.

The main aim of the series of renormalization group conferences has been to bring together scientists with backgrounds and expertise in the application of the renormalization group to problems in broadly different areas of physics, offering regular events for continuing such fruiful exchanges of ideas. We hope that the present collection of contributions to quantum field theory, mathematical and methodological aspects of the renormalization group, statistical mechanics, condensed matter physics, and stochastic dynamics conveys this spirit. We feel it amply demonstrates the breadth of activity of research based on the renormalization group and its potential for future work.

On behalf of the organizers of the conference, we would like to thank the sixty participants of the conference and the members of the Advisory Board for their contributions. Financial and organizational support of the University of Helsinki, the Academy of Finland, the Finnish Society of Sciences and Letters and the Naval Academy is gratefully acknowledged. We are very grateful to all authors who contributed to this special issue. Finally, we owe special thanks to all who assisted in the preparation of it, in particular to the staff of *Journal of Physics A: Mathematical and General*.

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Guest Editors