

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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The Renormalization Group

Organised by
Margherita Disertori, Rouen
Joel Feldman, Vancouver
Manfred Salmhofer, Heidelberg

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ABSTRACT. Invented as a multiscale approach to the theory of critical phenomena, the renormalization group has become a powerful mathematical tool in the analysis of infinite-dimensional systems. Its applications range from classical and quantum statistical mechanics and quantum field theory to partial differential equations, operator theory, and probability theory. Deep connections of renormalization group flows to geometric flows exist.

Mathematics Subject Classification (2000): 81T15, 81T16, 81T17, 82B05, 82C10.

Introduction by the Organisers

The workshop focused on the developments in this area since the last Oberwolfach workshop on this topic in 2006. The participants are from mathematics and theoretical physics institutes throughout Europe and North America.

Mathematical proofs by RG are often technically elaborate and demanding, but the workshop did not merely focus on technical issues. Besides presentations that provided a survey of important recent developments and some that exposed technical novelties, there were several talks that did not directly concern the RG but closely related fields, as well as potential new areas of application.

The topics covered in the 17 one-hour talks are many-body systems of quantum statistical mechanics relevant for materials science, in particular graphene, the Kosterlitz-Thouless transition in the two-dimensional Coulomb gas, nonlinear elasticity, aspects of quantum field theory (operator product expansions, renormalization in the Euclidian and on globally hyperbolic Lorentzian space-times), RG in stochastic population models, group quantum field theory, and the application of the RG to long-time limits of dynamics and the emergence of irreversible

behaviour. Two talks were devoted to geometric flows and their relation to RG flows.

The programme adhered to the Oberwolfach traditions, leaving plenty of room for discussions and joint work. The Oberwolfach atmosphere and the excellent service at the centre were most appreciated.