

Foreword

This book is the seventh in a series of lectures of the *Séminaire Poincaré*, which is directed towards a large audience of physicists and of mathematicians.

The goal of this seminar is to provide up-to-date information about general topics of great interest in physics. Both the theoretical and experimental aspects are covered, with some historical background. Inspired by the Bourbaki seminar in mathematics in its organization, hence nicknamed “Bourbaphi”, the Poincaré Seminar is held twice a year at the Institut Henri Poincaré in Paris, with contributions prepared in advance. Particular care is devoted to the pedagogical nature of the presentations so as to fulfill the goal of being readable by a large audience of scientists.

This volume contains the tenth such seminar, held on April 30, 2007. It is devoted to the application of non-commutative geometry and quantum groups to physics.

The book starts with a pedagogical introduction to Moyal geometry by Vincent Pasquier, with special emphasis on the quantum Hall effect. It is followed by a detailed review of Vincent Rivasseau on non-commutative field theory and the recent advances which lead to its renormalizability and asymptotic safety. The description of the quantum Hall effect as a non-commutative fluid is then treated in detail by Alexios Polychronakos. Integrable spin chains can be studied through quantum groups; their striking agreement with neutron scattering experiments is reviewed by Jean-Michel Maillet. The book ends up with a detailed description by the world famous expert Alain Connes of the standard model of particle physics as a spectral model on a very simple non-commutative geometry, including the recent progress on the Higgs sector and neutrino masses.

We hope that the continued publication of this series will serve the community of physicists and mathematicians at professional or graduate student level.

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