

Progress in Mathematics

Volume 319

Series Editors

Antoine Chambert-Loir

Jiang-Hua Lu

Yuri Tschinkel

More information about this series at <http://www.springer.com/series/4848>

Werner Ballmann • Christian Blohmann
Gerd Faltings • Peter Teichner • Don Zagier
Editors

Arbeitstagung Bonn 2013

In Memory of Friedrich Hirzebruch

Editors

Werner Ballmann
Max Planck Institute for Mathematics
Bonn, Germany

Christian Blohmann
Max Planck Institute for Mathematics
Bonn, Germany

Gerd Faltings
Max Planck Institute for Mathematics
Bonn, Germany

Peter Teichner
Max Planck Institute for Mathematics
Bonn, Germany

Don Zagier
Max Planck Institute for Mathematics
Bonn, Germany

ISSN 0743-1643

ISSN 2296-505X (electronic)

Progress in Mathematics

ISBN 978-3-319-43646-3

ISBN 978-3-319-43648-7 (eBook)

DOI 10.1007/978-3-319-43648-7

Library of Congress Control Number: 2016957869

Mathematics Subject Classification (2010): 00B20, 00B30

© Springer International Publishing Switzerland 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This book is published under the trade name Birkhäuser, www.birkhauser-science.com

The registered company is Springer International Publishing AG

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The first Arbeitstagung was organized by Friedrich Hirzebruch in 1957. The six participants were Michael Atiyah, Hans Grauert, Alexander Grothendieck, Friedrich Hirzebruch, Nicolaas Kuiper, and Jacques Tits. Already at the first Arbeitstagung the principle was established which was to become its most distinctive feature: The program was not determined beforehand by the organizers, but during the meeting by all participants in an open discussion, albeit skillfully guided by Hirzebruch. The curiosity about who would be speaking and on what topic was part of the excitement of this conference series, which quickly grew in popularity, reaching well over 250 participants in later years. More importantly, the spontaneous proposal of talks made it possible to always cover the latest developments in mathematics. Many important results, such as the Atiyah-Singer index theorem, were first introduced to the larger mathematics community at the Arbeitstagung. Moreover, it meant that the conferences were not confined to a specific topic, representing over the years almost all fields of mathematics.

The Arbeitstagung 2013 was dedicated to the memory of Friedrich Hirzebruch, who passed away on May 27, 2012. This volume contains contributions from speakers and participants, covering a variety of topics from algebraic geometry, topology, differential geometry, operator theory, and representation theory. We hope that it still captures some of the unique character and spirit of Fritz Hirzebruch's original Arbeitstagung.

Bonn, Germany
June 2016

Werner Ballmann
Christian Blohmann
Gerd Faltings
Peter Teichner
Don Zagier

Contents

The Hirzebruch Signature Theorem for Conical Metrics	1
Michael Atiyah	
Depth and the Local Langlands Correspondence	17
Anne-Marie Aubert, Paul Baum, Roger Plymen, and Maarten Solleveld	
Guide to Elliptic Boundary Value Problems for Dirac-Type Operators ...	43
Christian Bär and Werner Ballmann	
Symplectic and Hyperkähler Implosion	81
Andrew Dancer, Brent Doran, Frances Kirwan, and Andrew Swann	
Kazhdan–Lusztig Conjectures and Shadows of Hodge Theory	105
Ben Elias and Geordie Williamson	
Uniform Sup-Norm Bounds on Average for Cusp Forms of Higher Weights	127
Joshua S. Friedman, Jay Jorgenson, and Jürg Kramer	
Fivebranes and 4-Manifolds	155
Abhijit Gadde, Sergei Gukov, and Pavel Putrov	
Higgs Bundles and Characteristic Classes	247
Nigel Hitchin	
Hirzebruch–Milnor Classes and Steenbrink Spectra of Certain Projective Hypersurfaces	265
Laurentiu Maxim, Morihiko Saito, and Jörg Schürmann	
On Lusztig’s q-Analogues of All Weight Multiplicities of a Representation	289
Dmitri I. Panyushev	

The Triangulation of Manifolds: Topology, Gauge Theory, and History .. 307
Frank Quinn

Elliptic Calabi–Yau Threefolds over a del Pezzo Surface..... 337
Simon Rose and Noriko Yui

Remarks on Cohomological Hall Algebras and Their Representations ... 355
Yan Soibelman

**A Stratification on the Moduli of K3 Surfaces in Positive
Characteristic.....** 387
Gerard van der Geer

The Right Adjoint of the Parabolic Induction 405
Marie-France Vignéras

Contributors

Michael Atiyah School of Mathematics, JCMB, Edinburgh, UK

Anne-Marie Aubert Institut de Mathématiques de Jussieu – Paris Rive Gauche, U.M.R. 7586 du C.N.R.S., U.P.M.C., Paris, France

Werner Ballmann Max Planck Institute for Mathematics, Bonn, Germany

Christian Bär Institut für Mathematik, Universität Potsdam, Potsdam, Germany

Paul Baum Mathematics Department, Pennsylvania State University, University Park, PA, USA

Andrew Dancer Jesus College, Oxford, UK

Brent Doran Department of Mathematics, ETH Zürich, Zürich, Switzerland

Ben Elias Department of Mathematics, University of Oregon, Eugene, OR, USA

Joshua S. Friedman Department of Mathematics and Science, United States Merchant Marine Academy, Kings Point, NY, USA

Abhijit Gadde California Institute of Technology, Pasadena, CA, USA

Sergei Gukov California Institute of Technology, Pasadena, CA, USA

Nigel Hitchin Mathematical Institute, Radcliffe Observatory Quarter, Oxford, UK

Jay Jorgenson Department of Mathematics, The City College of New York, New York, NY, USA

Frances Kirwan Balliol College, Oxford, UK

Jürg Kramer Institut für Mathematik, Humboldt-Universität zu Berlin, Berlin, Germany

Laurentiu Maxim Department of Mathematics, University of Wisconsin-Madison, Madison, WI, USA

Dmitri I. Panyushev Institute for Information Transmission Problems of the R.A.S., Moscow, Russia

Independent University of Moscow, Moscow, Russia

Roger Plymen School of Mathematics, Southampton University, Southampton, UK

School of Mathematics, Manchester University, Manchester, UK

Pavel Putrov California Institute of Technology, Pasadena, CA, USA

Frank Quinn Department of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

Simon Rose Department of Mathematical Sciences, University of Copenhagen, Copenhagen, Denmark

Morihiko Saito RIMS Kyoto University, Kyoto, Japan

Jörg Schürmann Mathematisches Institut, Universität Münster, Münster, Germany

Yan Soibelman Department of Mathematics, KSU, Manhattan, KS, USA

Maarten Solleveld Radboud Universiteit Nijmegen, Nijmegen, The Netherlands

Andrew Swann Department of Mathematics, Aarhus University, Aarhus, Denmark

CP³-Origins, Centre of Excellence for Cosmology and Particle Physics Phenomenology, University of Southern Denmark, Odense, Denmark

Gerard van der Geer Korteweg-de Vries Instituut, Universiteit van Amsterdam, Amsterdam, The Netherlands

Marie-France Vignéras Institut de Mathématiques de Jussieu, Université de Paris 7, Paris, France

Geordie Williamson Max-Planck-Institut für Mathematik, Bonn, Germany

Noriko Yui Department of Mathematics and Statistics, Queen's University, Kingston, ON, Canada