

Advanced Lectures in Mathematics
Volume 44

Proceedings of the Seventh International Congress of Chinese Mathematicians

Volume II

Companion to the volume
Proceedings of the Seventh International Congress of Chinese Mathematicians,
Volume I

edited by

Lizhen Ji · Lo Yang · Shing-Tung Yau

 International Press
www.intlpress.com

 高等教育出版社
HIGHER EDUCATION PRESS

Advanced Lectures in Mathematics, Volume 44

Proceedings of the Seventh International Congress of Chinese Mathematicians, Volume II

Companion to the volume

Proceedings of the Seventh International Congress of Chinese Mathematicians, Volume I

Editors:

Lizhen Ji (Department of Mathematics, University of Michigan)

Lo Yang (Institute of Mathematics, Chinese Academy of Sciences)

Shing-Tung Yau (Department of Mathematics, Harvard University)

Copyright © 2019 by International Press, Somerville, Massachusetts, U.S.A., and by Higher Education Press, Beijing, China.

This work is published and sold in China exclusively by Higher Education Press of China.

All rights reserved. Individual readers of this publication, and non-profit libraries acting for them, are permitted to make fair use of the material, such as to copy a chapter for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews, provided the customary acknowledgement of the source is given. Republication, systematic copying, or mass reproduction of any material in this publication is permitted only under license from International Press. Excluded from these provisions is material in articles to which the author holds the copyright. (If the author holds copyright, notice of this will be given with the article.) In such cases, requests for permission to use or reprint should be addressed directly to the author.

ISBN: 978-1-57146-370-8

Printed in the United States of America.

22 21 20 19 9 8 7 6 5 4 3 2 1

ADVANCED LECTURES IN MATHEMATICS

Executive Editors

Shing-Tung Yau
Harvard University
Cambridge, Mass., U.S.A.

Lizhen Ji
University of Michigan, Ann Arbor
Ann Arbor, Mich., U.S.A.

Kefeng Liu
University of California at Los Angeles
Los Angeles, Calif., U.S.A.
Zhejiang University
Hangzhou, China

Editorial Board

Chongqing Cheng
Nanjing University
Nanjing, China

Zhong-Ci Shi
Institute of Computational Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China

Zhouping Xin
The Chinese University of Hong Kong
Hong Kong, China

Weiping Zhang
Nankai University
Tianjin, China

Xiping Zhu
Sun Yat-sen University
Guangzhou, China

Tatsien Li
Fudan University
Shanghai, China

Zhiying Wen
Tsinghua University
Beijing, China

Lo Yang
Institute of Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China

Xiangyu Zhou
Institute of Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China



第七届世界华人数学家大会
晨兴数学奖
颁奖典礼暨研讨会
二零一六年八月六日 | 中国北京人民大会堂

The Seventh International Congress of Chinese Mathematicians
**MORNINGSIDE MEDAL
OF MATHEMATICS**
Awards Presentation and Symposium
August 6, 2016 | The Great Hall of the People, Beijing, China

Honored guests of opening ceremony



The scene of opening ceremony



Prof. Shing-Tung Yau gave opening speech



Left to right: Prof. Shing-Tung Yau, Prof. Björn Engquist (the awardee of the International Cooperation Award), and Prof. Zhong-Ci Shi



Left to right: Prof. Shing-Tung Yau, Prof. Xi-Ping Zhu (the awardee of Chern Prize), and Prof. Lo Yang



Mr. Ronnie Chan (the awardee of Chern Prize) and Prof. Shing-Tung Yau



Left to right: Prof. Shing-Tung Yau, Prof. Wei Zhang (the awardee of Morningside Gold Medal of Mathematics), and Prof. Chunli Bai (President of CAS)



Prof. Edward Witten and Prof. Shing-Tung Yau



Left to right: Prof. Shing-Tung Yau, Prof. Yuefei Wang, Prof. Chumli Bai (President of CAS), and Prof. Yong Qiu (President of Tsinghua University)

Preface

Every three years, mathematicians of Chinese descent meet for five days to present their results on mathematics and related subjects. Traditionally, the first day of the meeting is organized by the Morningside Foundation, where the prestigious Morningside Awards, the Chern Award, and the International Cooperation Awards are given. In 2016, the International Congress of Chinese mathematicians (ICCM) was organized by the Morningside Center of Mathematics in cooperation with the Academy of Mathematics and Systems Science at Chinese Academy of Sciences. The ceremony was held in the Great Hall of the People in China. Nearly two thousand Chinese mathematicians from all over the world came to Beijing for this ceremony. Many outstanding mathematicians of non-Chinese descent also came and gave spectacular lectures. We are glad that a large number of speakers have been willing to write up their lectures, and we have finally collected these manuscripts through the hard work of Guangqiang Tie, and others. These papers provide good insight into the current status of many subjects in mathematics. We are proud to present them collected here. We should like to thank all participants, and the Morningside Center of Mathematics, for making such an effort to make the ICCM meeting and the publication of its proceedings successful.

Lizhen Ji, Lo Yang and Shing-Tung Yau

Contents

Invited Lectures

Algebra, Combinatoric, Number Theory, Automorphic Forms, Arithmetic Geometry, Cryptography

Structure and Representations of the Quantum Loop Algebra of \mathfrak{gl}_n 5

Bangming Deng, Jie Du, and Qiang Fu

Panorama on Ax Type Transcendence Results..... 33

Ziyang Gao

Totality of Acyclic Sign-skew-symmetric Matrices and Applications to Some Conjectures of Cluster Algebras..... 53

Min Huang and Fang Li

Whittaker–Fourier Coefficients of Cusp Forms..... 65

Zhengyu Mao

Invariant Distributions on the Nilcone..... 77

Cheng-Chiang Tsai

New Developments of Iwasawa Theory 87

Xin Wan

Towards Representations of Primes by Polynomials..... 99

Jie Wu and Ping Xi

Algebraic Geometry

Survey on Geometric Langlands and Non-abelian Hodge Theory in Characteristic p 125

Tsao-Hsien Chen

| | |
|--|-----|
| Generalized SYZ Mirror Transformation | 139 |
|--|-----|

Siu-Cheong Lau

| | |
|---|-----|
| Algebraic Actions of Discrete Groups | 155 |
|---|-----|

Junyi Xie

| | |
|--|-----|
| Geography of Irregular Varieties of General Type: Some Recent Results | 169 |
|--|-----|

Tong Zhang

Geometric Analysis, Differential Geometry, Symplectic Geometry, Topology

| | |
|--|-----|
| On Stationary Solutions to the Einstein Field Equations | 191 |
|--|-----|

Bing-Long Chen

| | |
|--|-----|
| Remarks of weak-compactness along Kähler Ricci flow | 203 |
|--|-----|

Xiuxiong Chen and Bing Wang

| | |
|---|-----|
| Convergence and Variational Aspects of the Kähler-Ricci Flow ... | 235 |
|---|-----|

Frederick Tsz-Ho Fong

| | |
|---|-----|
| The Topological Sphere Theorem for Odd-dimensional Compact Submanifolds with Pinched Ricci Curvature | 253 |
|---|-----|

Juan-Ru Gu and Hong-Wei Xu

| | |
|--|-----|
| An Example of Proving Almgrens Minimality by Product of Paired Calibrations | 269 |
|--|-----|

Xiangyu Liang

| | |
|---|-----|
| A Survey on Recent Progress of Yau's Uniformization Conjecture | 285 |
|---|-----|

Gang Liu

| | |
|--|-----|
| Timelike Minimal Submanifolds of Minkowski Spaces | 301 |
|--|-----|

Willie Wai Yeung Wong

Mathematical Physics, General Relativity, Complex Geometry, CR Geometry, Complex Analysis,

Several Complex Variables, History of Mathematics

Quasimap SYZ for Toric Calabi-Yau Manifolds..... 317

Kwokwai Chan

Levi's Problem, Convexity, and Squeezing Functions on Bounded
Domains 335

Fusheng Deng

On the Refined Open Gromov-Witten Invariants on K3 Surfaces . 351

Yu-Shen Lin

Dynamical Black Holes with Prescribed Masses in Spherical
Symmetry..... 367

Jonathan Luk, Sung-Jin Oh, and Shiwu Yang

Solutions of Friedmann's Equations and Cosmological
Consequences..... 389

Yisong Yang

Local Holomorphic Isometries, Old and New Results..... 409

Yuan Yuan

Dynamical System, Control Theory, Optimization, Functional Analysis, Fractal

Measures of the Full Hausdorff Dimension for Sofic Affine-invariant
Sets on \mathbb{T}^2 423

Jung-Chao Ban, Chih-Hung Chang, and Ting-Ju Chen

Levenberg-Marquardt Methods and Trust Region Methods for
Nonlinear Equations..... 459

Jinyan Fan

Numerical Analysis, Scientific Computing, Imaging, Bio-Mathematics, Machine Learning, Probability, Statistical Theory and Method, Application of Statistics

Sparse CCA via Precision Adjusted Iterative Thresholding..... 481

Mengjie Chen, Chao Gao, Zhao Ren, and Harrison H. Zhou

| | |
|---|------------|
| An Efficient High-Order Integral Equation Method for Solving the Heat Equation with Complex Geometries in Three Dimensions . . . | 535 |
| <i>Shidong Jiang and Shaobo Wang</i> | |
| Some Recent Developments in Matrix Analysis and Computation | 555 |
| <i>Xiao-Qing Jin, Seak-Weng Vong, Ze-Jia Xie, and Zhi Zhao</i> | |
| Recent Developments in Eulerian Approaches for Visualizing Continuous Dynamical Systems | 579 |
| <i>Shingyu Leung, Guoqiao You, Tony Wong, and Yu-Keung Ng</i> | |
| Compressed Sensing with Redundant Dictionaries | 623 |
| <i>Song Li</i> | |