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Recent Developments in Algebra and Related Areas

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ADVANCED LECTURES IN MATHEMATICS

Preface

This volume contains papers presented at the International Conference on Algebra and Related Areas, held in Tsinghua University, Beijing, China, during August 18–20, 2007. The conference was dedicated to Professor Zhexian Wan in honor of his 80th birthday. About two hundred researchers, including graduate students and young mathematicians from China, Japan, Singapore, Australia, the Netherlands, Italy, and the United States, participated in this conference. There were fifteen invited lectures by well-known experts on algebraic geometry, combinatorics, coding theory, Lie algebras, representation theory of finite groups and algebraic groups, vertex operator algebras and their applications.

Professor Wan's contributions to mathematics are legendary. His extensive research covers many areas on mathematics, such as classical groups, geometry of matrices, finite fields and finite geometry, Lie algebras, combinatorics, graph theory, lattice theory, coding theory and cryptology, design theory with many fundamental results. In classical groups, Professor Wan investigated the structure and automorphism groups of various subgroups and quotient groups of classical groups over fields and skew fields. In particular, he and his former students Hongshou Ren and Xiaolong Wu proved in 1986 that all automorphisms of the two-dimensional special linear group over an arbitrary skew field are standard, and all isomorphisms between two-dimensional special linear groups over skew fields are standard with only one exception. This completely solved the very difficult problem on automorphisms and isomorphisms of linear groups over skew fields. In geometry of matrices, he systematically investigated the geometry of symmetric matrices, the geometry of alternate matrices, the geometry of hermitian and skew-hermitian matrices, generalizing the Fundamental Theorem of Projective Geometry to the geometry over arbitrary fields and skew fields with involution, and giving some applications to graph theory. The study of finite geometry and its applications in China was initiated by Professor Wan. He studied the action of various classical groups on vector spaces over finite fields. He developed a new theory to classify the orbits and to determine the lengths of orbits and related. He also applied these results to combinatorial design, information security, coding theory and graph theory, and obtained many important results. Besides, he gave a beautiful proof for a graphic method for solving the transportation problem and he solved a problem on linear shift register sequences. There is no doubt that Professor Wan is the leader in the Chinese algebra community, and the influence of his work over the half century will last for many years to come.

We are very grateful to the China and U.S. National Science Foundations, International Mathematical Union, Tsinghua University, Institute of Systems Science of Chinese Academy of Sciences, and many individuals for the organizing and support of this conference. We would like to sincerely thank all the participants, speakers, and authors for all their efforts and timely submissions, thereby making the conference a success. We appreciate the referees for their excellent review work. Thanks also go to the Higher Education Press and the International Press to publish these conference proceedings as one of the series Advanced Lectures in Mathematics.

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Contents