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Selected Papers of Morikazu Toda

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SELECTED PAPERS OF MORIKAZU TODA

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Foreword

This volume contains selected papers of Dr. Morikazu Toda. The arrangement of papers is in chronological order of publishing dates. His contributions to theoretical physics are legion. There is little need to tell the significance of these papers which speak for themselves. I think, however, it may be interesting and convenient to the reader to mention briefly his scientific career.

Morikazu Toda was born in Tokyo on the 20th of October 1917. He graduated from the Department of Physics, University of Tokyo, in 1940. After serving as an associate professor first at Keijo University and then Tokyo University of Education (Kyoiku University), he was promoted to professor in 1952 at the age of 34. He was a professor at Chiba University, Yokohama National University and University of the Air. Meanwhile, he was a visiting professor at São Paulo University and University of Trondheim. He is a professor emeritus of Tokyo University of Education and a member of the Royal Norwegian Academy of Science.

Morikazu Toda's main interests are statistical mechanics and condensed matter physics. Among his many contributions, we should mention his works on liquids and nonlinear lattice dynamics. The one-dimensional lattice where nearest neighboring particles interact through an exponential potential is called the Toda lattice. The Toda lattice is a miracle and indeed a jewel in theoretical physics. He received the Mainichi Shuppan-Bunka prize for his contribution to the theory of liquids in 1947 and the Fujiwara prize for discovery of the Toda lattice in 1981.

I am grateful to Professor Akinobu Shimizu and Dr. Noriko Saitoh, Yokohama National University, for their efforts in preparing this work. I am glad to acknowledge the cooperation of World Scientific Publishing and especially of Ms. H. M. Ho who took charge of compiling this volume.

Miki Wadati, editor

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Preface

Some of my scientific papers are collected in this book. My scientific career started just before the Second World War, and some of my works of that time were written in Japanese. Among these, a paper on the virial theorem, translated for this issue, presents a method of statistical thermodynamics. For a period of time, I was then interested in the theory of liquids, and low temperature physics. From about 1957, we had a group of physicists who were interested in exact solutions rather than approximate methods, since computer experiments were just revealing that conventional perturbation methods sometimes failed in grasping specific features of phenomena such as the localization of wave functions and vibrational modes around impurities, enhancement of heat flow by nonlinearity of interaction between lattice particles, and so on.

My study of nonlinear system was advanced when I found papers of J. Ford(1961,64), who examined the vibration of lattices with small number of particles and clarified that certain one-dimensional nonlinear lattices marvellously sustain the character of linear modes (his study was initiated by the famous computer experiment by E. Fermi et al., but I could not see it at that time). I thought there would be a lattice model with particular interaction between particles, which admits exact periodic waves, and finally found the integrable nonlinear lattice system.

It is my great pleasure to thank many friends who have shared interest in the lattice problems and nonlinear problems, including E. Teramoto, H. Matsuda, S. Takeno, F. Yonezawa, N. Saito, T. Kotera, Y. Ichikawa, R. Hirota, M. Wadati, J. Satsuma and S. Watanabe.

It was found desirable to have a collection of some of my papers to distribute among seminars in several laboratories, and first I intended only to bind copies and reprints. However, one of my colleagues kindly suggested to make a book, and this is the outcome. Most of my papers on nonlinear lattices are presented. It also includes some of my earlier works which seem to have some originality according to my own dogma and prejudice. It is my sincere hope that this book may give basis for discussion and development for future study.

It is a pleasant duty to thank M. Wadati for editing and writing the Foreword. I am grateful to the staffs of the Department of Applied

Mathematics, Faculty of Engineering, Yokohama National University for kind efforts which enabled the publication of this book, especially to A. Shimizu and N. Saitoh. Thanks are also due to the staff of World Scientific Publishing Co. for kind assistance.

April, 1993

Morikazu Toda

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