

Preface

My journey in statistical mechanics began over four decades ago. The 1960s was a golden time in statistical mechanics, when the modern theory of critical phenomena was taking shape. New models of phase transitions were formulated, analyzed, and solved almost daily, and new knowledge of critical phenomena accumulated at lightning speed. I was fortunate to get involved in these exciting developments at an early stage of my career.

In the last two decades, statistical mechanics has further branched out to other areas of physics and science such as pure mathematics. With statistical mechanics reaching far and beyond, it has become more difficult and formidable to those who wish to break into the field.

This book is aimed at alleviating this situation. Over the years I have established my own way of appreciating and understanding statistical mechanics, particularly with respect to exactly solvable models and their connections and applications outside the traditional realm. I have written expository and pedagogical articles on many new developments, and it has been suggested to me by friends and colleagues that I synthesize my works into a monograph. This book is an attempt in that direction.

The goal of this book is two-fold. First, it introduces students and researchers to the many facets of exactly solvable models and the role they play outside traditional statistical mechanics. Second, the book is a reprint volume of selected papers of mine that are pedagogical in nature. To achieve the goals, I have arranged the reprinted papers into chapters according to topics, and written commentaries introducing each chapter topic starting from scratch. Commentaries are sufficiently self-contained to be useful and resourceful. A diligent student, for example, should be able to work out the Jones polynomial of knots from the Potts model after reading the chapter on knot invariants. The commentaries also describe my work and the background of some of the research papers, thereby giving students a flavor of how research ideas are formed. Lastly, the book is a faithful travelog of the arduous yet thoroughly fulfilling journey I have taken in the past four and half decades.

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I am especially grateful to my good friend Jean-Marie Maillard who, on the eve of my 70th birthday, took the tedious trouble to write a 52-page review of my whole life's research. His article is included in the Appendix as snapshots from my journey in statistical mechanics. Finally, and most importantly, I thank my wife Jane Ching-Tsu for always being by my side throughout the 45 years of our marriage. Without her unwavering support and understanding, I would not have been able to complete the journey.

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