

PREFACE

This book is based on a course on many-body theory I had been asked to give in the Postgraduate Teaching Program of Physics in French Switzerland (Troisième Cycle de Physique en Suisse Romande) at the Federal Institute of Technology (Ecole Polytechnique Fédérale) in Lausanne during the summer terms of 1982 and of 1985. But some of the materials had already been presented at earlier invitations, 1962 in Leysin (IVe Cours de Perfectionnement de l'Association Vaudoise des Chercheurs en Physique), 1965 in Lausanne (Troisième Cycle, notes by Michel Romério) and in Geneva (University, notes by Fabio Barblan), 1967 in Trieste (International Centre for Theoretical Physics), 1968/69 in Lausanne (Troisième Cycle, notes by Michel Droz), 1969 in Majorca (International School of Physics) and 1971 in Geneva (Troisième Cycle, notes by Dionys Baeriswyl). In comparing these different courses the evolution, both in scope and in sophistication appears striking to me. Interestingly, this evolution is both, my own and that of physics itself. The last decades have indeed brought exciting discoveries and interpretations in ever faster succession. For this reason I think it is a good time now to write such a book, in spite of the large number of already existing texts on many-body theory. On a more personal level this timing also means a certain retrospective.

My ambition and satisfaction in writing this book was to reach a self-contained unity by giving as complete explanations as possible. This of course is a time-consuming and often frustrating task. But when I think of the disappointments in reading certain theoretical reviews which just repeat formulas without explaining them I become convinced that I did the right thing. But the question now is how well these explanations withstand criticism. Fortunately, in several instances I benefited from clarifying

discussions with Daniel Loss, Ching Zhou and Ora Entin-Wohlman which I acknowledge gratefully here.

Wanting to “leave nothing unexplained” of course sets other limits. So I had to leave out many exciting topics or cover them only with few words instead of detailed expositions. This, however, is the author’s privilege which is comparable to that of a conductor’s: it is he who selects the music to be performed. But he also works with the musicians to realise his interpretation, which may or may not be applauded in the concert hall. The performers in the orchestra, on the other hand, have to work their daily exercises at home if they wish to belong to the orchestra or even become soloists. For the students of this book there is also a selection of exercises, all with detailed solutions and many of a similar kind just as the scales of the musicians all resemble each other. In this sense the book is indeed a course, as also in the exposition of the two introductory chapters, in particular the combinatorial toccata leading to Wick’s theorems for a complex time path which is my composition.

The material of the remaining three chapters, however, is selected more according to its research interest. Topics like localization by disorder or mesoscopic transport had greatly fascinated me because of their lack of intuitive evidence. Then of course came high- T_c superconductivity, resounding like a huge Richard Strauss orchestra; it still rings in the ears. But the topic of most concern to me had always been the problem of magnetism. I even had doubts of ever grasping the subject as a unity and I did not find much help in books or reviews. But what came out of a considerable effort as Chapter 5 reassures me that there may indeed be some unity and intelligibility in the matter. In all these efforts I was helped by Francine Gennai-Nicole in typing the manuscript in \TeX and by Jean-Gabriel Bosch in drawing the figures in MacDraw. The numerous computer problems I ran into were all solved with great competence and patience by Andreas Malaspinas. To all three I address my sincere thanks for their expert help.

Many readers may find my style tiresome because of the obsession of “leaving nothing unexplained”. I have no excuse for this because it is both personal and eminently Swiss. Indeed, it is the attitude that made Swiss watch-makers famous and let the people of this country be concerned with the security of the Alpine passes ever since the foundation of the Confœderatio Helvetica 700 years ago. Since this book is ready just for Lady Helvetia’s big celebration it gives me pleasure and pride to dedicate it to Her 700th anniversary.