Preface

> *She* [field theory] *is not a robust mate ready to pitch in and lend a helping hand. She is a haunting mistress, refined, and much too beautiful for hard work. She is at her best in formal dress, and thus displayed in this book, where rigor will be found to be absolutely absent.* Bryce S. DeWitt

Since the above characterization appeared [1] in 1965 we have witnessed great progress in quantum field theory, our description of fundamental particles and their interactions. This book displays her in informal dress, robust and ready to give results, rigorous, while at a pedestrian mathematical level. By approximating space–time by a collection of points on a lattice we get a number of benefits:

- it serves as a precise but simple definition of quantum fields, which has its own beauty;
- it brings to the fore and clarifies essential aspects such as renormalization, scaling, universality, and the role of topology;
- it makes a fruitful connection to statistical physics;
- it allows numerical simulations on a computer, giving truly non-perturbative results as well as new physical intuition into the behavior of the system.

This book is based on notes of a lecture course given to advanced undergraduate students during the period 1984–1995. An effort was made to accomodate those without prior knowledge of field theory. In the present version, examples from numerical simulations have been replaced

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by more recent results, and a few sections (8.3–8.6) on lattice aspects of chiral symmetry have been added. The latter notoriously complicated topic was not dealt with in the lectures, but for this book it seemed appropriate to give an introduction.

An overview of the research area in this book is given by the proceedings of the yearly symposia 'Lattice XX', which contain excellent reviews in which the authors tried hard to make the material accessible. These meetings tend to be dominated by QCD, which is understandable, as many of the physical applications are in the sphere of the strong interactions, but a lot of exciting developments usually take place 'on the fringe', in the parallel sessions. In fact, Lattice XX may be considered as *the* arena for non-perturbative field theory. The appropriate papers can be retrieved from the e-print archive http://arXiv.org/ and its mirrors, or the SPIRES website http://www.slac.stanford.edu/spires/hep/

I would like to thank my students, who stumbled over my mistakes, for their perseverance and enthusiasm, and my colleagues for collaborations and for sharing their insight into this ever-surprising research field.

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