Special Preface

I reread *Concepts in Solids* with both pride and embarrassment. Pride, both because it was this set of lectures which inspired Brian Josephson to invent his effect--not every book can point to the precise Nobel prize it inspired--and because I did, in a very brief space, manage to touch some of the key topics which are still not adequately covered in your average solid state theory book. For instance, it is shocking that the main texts used in this country still do not touch on the Mott transition or the "Magnetic State." I was aiming at conceptual, not mechanical physics, and I hope I got there.

Embarrassment, because after all, there has been 30 years of physics since then. For instance, I note that I guessed absolutely wrong in dismissing tight-binding theory out of hand: it has not yet totally come into its own but it is, in my present opinion, the right way to think about most bonding in solids. I am not ashamed of skipping localization--only Mott was interested in it, and neither of us yet knew where to go next. I was prescient about broken symmetry—as Josephson realized—but left out phase transitions, as I myself noted.

Nonetheless, I believe that the average student will still be harmed less by this book than by any number of other books I should not name, and I welcome the reissuance.

P. W. Anderson
March 1991

Preface

These notes were for a course given at the Cavendish Laboratory, Cambridge, in the fall and winter terms of 1961-1962. Nominally, it was for second- and third-year graduate students who had had a survey course in solid-state physics, and were interested (at least) in theory; but I assumed very little formal theoretical background. I think the notes can be read by anyone who has had a thorough course in quantum mechanics, but the reader who knows something about solids will find them much easier, and will also not be misguided by my rather arbitrary and specialized choice of material.

The idea of the course was to teach a number of central concepts of solid-state physics, trying to choose those — band theory, nearly free electrons, effective Hamiltonian theory, elementary excitations, broken symmetry — which lay as near as possible to what I consider to be the main stream of development of the subject. Such a choice is necessarily arbitrary — whose fields, such as dislocation theory, transport theory and fluctuation-dissipation theorems, magnetic resonance theory in all its forms, and critical fluctuations, which could easily be argued to be quite as important, were ignored, simply because the course was of finite length. My choice of examples was even more arbitrary. For instance, the choices of the electric field case of effective Hamiltonian theory and of excitons to illustrate collective excitations were made because I thought the students were likely to encounter the more usual examples elsewhere. From time to time, to liven the course up a bit, I introduced original material; the discussions of the limitations of nearly free electron theory, of the philosophies of elementary excitation theory, and of broken symmetry are new, and that of the magnetic state is not widely available.

The language and presentation are very informal; very few changes were made from my original lecture notes as written. I might add that little effort has been made to bring them up to date. Both limitations are of course implicit in the idea of a lecture note volume.

I would like to express my gratitude for the hospitality of Professor Mott and the

Cavendish Laboratory, the secretarial staff of which prepared the original version of the notes. Mr. Liu Sham was kind enough to edit the notes and write in most of the equations.

P.W. ANDERSON

Murray Hill, New Jersey
January 1963