THE Theory of Superconductivity. P. W. Anderson. Princeton University Press, 41 William Street, Princeton, NJ 08540, USA. 446 pp. Price: US $49.50.

The capitalization in the first word of the title suggests that the author regards one of the biggest current problems in physics as solved. The average reader will perhaps be surprised, or even startled. This is of course, vintage Anderson, stimulating, designed to stir things up and make people think, and often rethink things and matters that were assumed to be well understood.

This book arose from a series of lectures given by Anderson, one of the great minds in condensed matter physics, in the Spring Semester 1988 at Princeton University, followed by a series of preprints. The latter have been circulated among a set of physicists around the world, working on the 'hot' problem of high T_c superconductivity starting early 1987, and have been influential in the community, and with the publication of this book, these will now be widely available. The serious students of condensed matter in India will benefit greatly from a study of this book.

The book consists of two parts, the first is the core of the book and has seven chapters where the problem of high T_c superconductivity is defined and declared to be solved in essence. The second part consists of several reprints of articles by Anderson and colleagues, and the selection here is geared at filling in the details of the ideas expounded in the first part.

Chapter 2 is in some ways the most absorbing part of the book. Here Anderson propounds the 'central dogma', a set of aphoristic *sutras*, meant to '... limit serious discussion of the mechanisms and theories to those which (were) are consistent with logic and with the overall burden of experimental fact, while allowing a great deal of freedom in working out specific mechanisms ...'. Anderson clarifies that the word 'dogma' is used not to imply their elevated origins, but rather in the sense that 'they are mostly empirical generalizations so direct and persuasive that it would seem perverse or frivolous to ignore them'. Here Anderson is very revealing about his own methodology when he warns that 'the students may not be familiar with the process of rigorous deduction from theoretical concepts combined with a broad range of experimental facts...'. This definition and usage of *physical rigor*, as opposed to the more conventionally understood *mathematical rigor* somehow seems to be the underlying ideology in this book. The author often dares to draw conclusions that are suggested by a combination of several physical indicators, even when calculations are less clear cut. In an overdetermined system with a large number of detailed and excellent experiments to reconcile and integrate, such a viewpoint seems eminently profitable.

The analysis of several normal state properties, such as the anisotropic resistivity, Hall angle, optical and infrared spectroscopy, angle resolved photoemission studies of the Fermi surface, and NMR/neutron scattering studies take up the major portion of Chapter 3, and are notable for a detailed and insightful look at some of the best experiments and for their theoretical implications.

Chapter 4 discusses some of the above experiments in the superconducting phase, together with the author's views on the symmetry of the order parameter – he feels this is an overemphasized issue in view of the mixing of the *d*-wave and *s*-wave order parameters in the case of an orthorhombic crystal group, for YBCO.

Chapter 5 contains a discussion of the 1-d Hubbard model. This is one of the best known integrable models in condensed matter physics, and has attracted enormous attention from mathematically oriented physicists in the past. This chapter contains Anderson's somewhat unique way of thinking about this model, and its correlation functions, wherein he shows how one can extract the non-Fermi liquid behaviour by viewing the problem in the framework of the infrared catastrophe and Kondo problems.

In chapter 6, the two dimensional 'Tomographic Luttinger Liquid' is discussed and the author reasons that two dimensions is more like one dimension than three. Several calculations presented are in a technical sense non-persuasive. In the calculations it is argued that the phase shift at the Fermi level is non-zero in two dimensions. It is shown to lead to a singular forward scattering, and hence a non-Fermi liquid. The calculation is done within a framework that is not 'conventional many body physics', since it relies upon unusual ways of doing business, such as the replacement of interactions by changing boundary conditions.

Chapter 7 contains important consequences of the theory, where the interlayer tunneling idea is introduced. The experiments, in this aspect, are most persuasive in that larger the number of layers in a family, the higher the T_c. Diagonalizing the one-body operator and then turning on interactions, is stated to be different from turning on one-body hopping connecting two interacting planes. This fundamental 'non-commutativity' justifies the theory, consisting of using a 'one-body operator, the hopping across the *c-axis*' connecting two planes, within a gap equation formulation as one would a two-body operator.

Many will no doubt complain that calculations such as those in chapter 6 or elsewhere are not readily reproducible by standard methods. While such objections are natural, it seems to me that despite these, the book is very likely to be the center of attention for many years to come. On the one hand, a tightly-knit group of physical arguments that 'hang together' are presented here in a cogent and collected form. These do form the best possible 'targets' for detailed analysis or calculations. What Anderson has given us is an integrative view of a highly complex problem, which if not actually providing us with a complete solution, at the least sets the standard for the breadth of vision required of other players of the game.

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