reducing the effectiveness of daylight bombing raids led Henry Tizard to anticipate that the enemy would turn to night bombing. The ground control system based on the warning net would be able to direct fighters to within four or five miles of an intruder, close enough to enable closure based on visual contact by day. But at night one could expect to see for no more than about 1000 feet.

With the encouragement of Watson-Watt, the project director, Bowen undertook to develop a radar system small enough to be carried in a night-fighter aircraft. This first effort to construct an air-interception radar led to several successive operational versions. The British began to install these systems in night-fighter aircraft before the war, when there was no source available for microwaves; they operated at wavelengths in the meter range. Bowen tells of demonstrating his experimental system, mounted in a two-place night-fighter, to prominent authorities in 1936. It was not easy to squeeze into the rear compartment such portly third riders as Winston Churchill, his friend and chief science adviser F. A. Lindemann (later Lord Cherwell) and Watson-Watt to share the seat with the radar operator—either Bowen or Robert Hanbury Brown. Bowen provides evidence of Cherwell's coolness toward radar, a part of an oft-described disagreement between Cherwell and Tizard. From the days after the impressive demonstration in the US of the operation of the pulsed-cavity magnetron at Bell Labs, Bowen tells an amusing anecdote of the accident that led to American magnetrons being made with eight cavity resonators, while the British had only six during the early months of manufacture.

We must be very grateful to Bowen for giving us a fascinating and personal account of the efforts of that small group of talented and dedicated men who so correctly anticipated the coming crisis and, by their constructs, gave others a chance to join in and finally to overwhelm a common foe. The book tells an important story with the authority, sensitivity and wit that only its main actor, Bowen, could provide.

Statistical Mechanics

Shang-Keng Ma
World Scientific, Singapore (Teaneck, N. J.), 1985. 548 pp. $74.00 hc ISBN 9971-966-06-9; $33.00 pb ISBN 9971-966-07-7

Shang-Keng Ma, formerly professor of physics at the University of California, San Diego, died in his home in La Jolla on 24 November 1983. He was recognized as a leading theoretical physicist and educator in statistical mechanics. He left many legacies to physics, among which was a book he had written in Chinese. The book, now translated, stands in the same relation to conventional graduate texts on statistical mechanics as does the two-volume treatise *Statistical Physics* by Lev Landau and Evgenii Lifshitz (Pergamon, New York, 1980). It is not a book to be used for a first reading of the subject—or even a second reading. However, it (potentially) exemplifies the "third-book rule": The third book a student reads on a subject is always the best! The topics treated demand rather more sophistication than is typical of graduate students—or of many experienced practitioners. Nonetheless there are gems in this book totally missing from standard texts on statistical mechanics.

But before discussing the gems, let us outline the book itself. It is divided into seven parts, with the headings Equilibrium, Hypothesis, Probability, Applications, Dynamics, Theoretical Bases and Condensation. In the introduction, Ma calls the first three parts "elementary" (rather an understatement) and the last four "more difficult." The introduction also sets the book's tone: a rare combination of depth of physical understanding and attention to concrete numerical facts. The introduction concludes with a disarmingly short list of very practical mathematical formulas, including a handful of extremely useful numerical relations (such as the fact that $2^{20} \simeq 1\,000\,000$).

This book avoids discussing the concept of ensembles, Ma having stated already in the preface that "the concept of ensembles is unnecessary and indeed not compatible with reality." This is not to say that Ma can establish the fundamentals of statistical mechanics on a new and firmer foundation. Rather, he considers statistical mechanics to be an "ill-proportioned subject, with many successful applications but relatively little understanding of basic principles." This humility before the fundamentals is characteristic of the presentation throughout the book. For example, he regards the basic assumption that a state occurs with a probability proportional to $\exp(-H/T)$ as a "rule for calculation"—a prerequisite for progress, but nonetheless an assumption devoid of justification.

Now to the gems: Having worked in both particle physics and condensed matter physics, Ma is adept at

drawing examples that illustrate important principles of statistical mechanics. For example, he devotes an entire chapter to echo phenomena, and another chapter on models with continuous symmetry presents a comprehensive overview of our present knowledge of the *XY* model and its realizations. Not all the "gems" pertain to such specialized topics. For example, Ma's chapter on phase equilibria presents the best picture of the growth of water droplets that I have read to date.

As remarked at the outset, this book is less a graduate text and more a supplement for the student well trained in quantum mechanics and condensed matter physics who wishes more challenge and more up-to-date topics than a typical graduate-level course affords. However, the instructor who adopts the book as a primary text will welcome the generous number of problems (some straightforward and others not) that appear at the end of each of the 30 chapters. Some of these problems are real beauties (such as "Show that in a collective model of carbon atoms, with a rigorous proof we can rule out the existence of diamond"), while others (such as "Derive all the results in Sec. 9.1") reflect the fact that the reader is asked to do a great deal of hard work to follow the text.

Instructors accustomed to including the dozen or so basic topics that fill the pages of most texts may be surprised to find some of those given rather brief treatment here. Not only are some traditional topics omitted, but so also are ones close to Ma's own fields of expertise. Thus critical phenomena and the renormalization group approach pioneered by Kenneth Wilson, Leo Kadanoff, Michael Fisher and others are almost entirely absent. Also left out are the connections with path integrals and the sort of connections between particle physics and statistical mechanics so nicely discussed in *Quarks, Gluons and Lattices* by Michael Creutz (Cambridge U. P., New York, 1983).

Moreover, some instructors may experience difficulty in adapting class lectures to the particular chapter ordering that Ma adopts; for example, a nice chapter on probability appears as chapter 10 in part III—not at the beginning, which is the traditional placement of this material in many classroom courses.

This book could potentially take a place alongside the classic monograph of Landau and Lifshitz as a valuable reference tool. With statistical mechanics playing an increasing role at the frontiers of condensed matter physics, Ma's book will almost certainly provide a challenge to the intellects of a growing number of active researchers.

H. Eugene Stanley
Boston University

The Electrical Resistivity of Metals and Alloys

Paul L. Rossiter
Cambridge U. P., New York, 1987. 434 pp. $79.50 hc
ISBN 0-521-24947-3

Our knowledge and detailed understanding of the electrical resistivities of metals and alloys has expanded greatly in the past two decades, due both to careful new measurements on a wide variety of systems and to theoretical advances. In pure metals, the dominant electron–phonon contribution to the temperature-dependent resistivity of a simple metal such as potassium has been derived with no adjustable parameters and shown to be in excellent agreement with experimental data. Real progress has been made in understanding topics such as electron–electron scattering, electron–surface scattering and electron–dislocation scattering. In alloys, self-consistent coherent potential approximation calculations have been shown to reproduce the impurity resistivities of some disordered alloys (for example, Ag–Pd) over most of the impurity concentration range with input of only the atomic numbers and the alloy lattice parameters. Advances have also been made in understanding effects of such phenomena as short-range and long-range order, clustering and phase separation; and progress has been made in understanding the magnetic behavior of alloys. Much, however, still remains to be done.

Paul Rossiter, a theorist who has contributed to our understanding of the effects of microstructural deviations from perfection on the electrical resistivities of both magnetic and nonmagnetic alloys, has summarized the work of many people in his book, which is designed primarily for researchers studying the resistivities of alloys. A variety of books and review articles describe basic scattering theory and its applications to the resistivities of pure metals and to some properties of alloys, and data collections are available for both metals and alloys. However, no other text so thoroughly covers the range of theoretical approaches needed specifically for alloys, or applies them to so wide a variety of alloys: dilute and concentrated; atomically ordered and disor-