tected from zealous defense researchers who want to breach the next frontier lest the adversary do so first."

The technical level of the book and its descriptions of the various technologies envisaged for development in the SDI program are aimed at the "scientific layman." For a more detailed discussion of these technologies, the reader is referred to the excellent 1987 study by the American Physical Society (Rev. Mod. Phys. **59**, S1, 1987) that is frequently referenced in the book.

Overall, *A Shield in Space* is a valuable addition to the "arms control" bookshelf, providing a good, well-referenced discussion of all the political and technical issues relevant to the SDI debate.

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Principles of Magnetic Resonance

C. P. Slichter
Springer-Verlag, New York, 1990 [1978]. Third edition. 655 pp. $49.50 hc
ISBN 0-387-50157-6

Magnetic resonance—nuclear magnetic resonance and electron paramagnetic resonance—had its beginnings as a phenomenon of interest to a handful of solid-state physicists. The techniques have subsequently evolved into what are probably the single most important tools for investigating a number of properties of solids. The 1950 discovery of the chemical shift and indirect spin couplings in nmr spectra and the realization that these spectral features provide the capability of identifying different molecular species, attracted many chemists to the field. Their interest was further stimulated by the ability to determine rates of chemical reactions; thus, nmr provides information on both molecular structure and dynamics.

The field continued to expand during the 1970s and '80s, driven by both technological and scientific advances. In particular, the development of superconducting solenoids; minicomputers; and rf, microwave and digital electronics provided the capability to perform a variety of experiments that were previously either cumbersome or impossible. Pulsed and Fourier-transform methods quickly replaced the once standard cw techniques and led to the development of multidimensional spectroscopy—first two-, then three- and now four-dimensional experiments. In addition, during this period there was an explosion in the development of techniques for performing high-resolution spectroscopy of solids, so that it is now possible to routinely obtain a high-resolution nmr spectrum of virtually any material. Thus, the condensed matter physicists, who in the late 1960s left the field, now found that magnetic resonance had left them. Finally, magnetic resonance imaging today provides the materials scientist, the biologist and the physician with a means to examine nondestructively new materials, cells and the human body. Thus, magnetic resonance has had a profound effect not only on the development of physics, but also on chemistry, biology and, most recently, medicine.

Because magnetic resonance affects so many disciplines, the appearance of the third edition of Charles Slichter's now classic textbook *Principles of Magnetic Resonance* is both timely and important. It is timely, since large numbers of new researchers continue to enter the field, and it is important since the book provides an updated and enlarged introduction to the essential aspects of magnetic resonance. The material in chapters 1–5, 10 and 11 was present in the original 1961 edition of the book, which emerged from Slichter's tenure as Morris Loeb Lecturer at Harvard. These chapters cover the basic theory of magnetic resonance, dipolar broadening, the interaction of nuclei with electrons, quadrupole effects and epr, and they introduce the density matrix. In 1978 the second edition appeared, enlarged by chapters 6–8, dealing with spin temperature, double resonance and multiple pulse methods, respectively. Much of the new material in this third edition is contained in these chapters and reflects the expansion of the field along these avenues. Chapter 9, discussing multiple quantum coherence, is also new.

The breadth of a field like magnetic resonance requires that an author be familiar with a large number of different subjects. Slichter's own research has covered a number of areas in fundamental nmr and epr, and in the applications of these techniques to surfaces and most recently to high-T_c superconducting materials. His many important contributions have placed him at the forefront of research in the field for three decades; thus, no more authoritative person could be found to author a book on the subject. This broad perspective of the field is especially important in writing a book like *Principles*, since it is inevitable that material of specific interest to many individuals will be omitted. Thus, an author is forced to make judgments as to what is and is not essential and important. In my opinion Slichter's choices of subject matter are excellent in that he discusses the fundamentals of every area of current importance in the field.

In writing *Principles*, Slichter did not aim to provide an exhaustive account of all aspects of magnetic resonance. Instead his intent was to prepare a textbook that presents the fundamentals underlying the many diverse branches of the subject. When the student has mastered these, he or she should be able to proceed with studies of the literature or more specialized books devoted to specific topics. Slichter introduces the many areas of magnetic resonance with an emphasis on developing a physical understanding and the essential theoretical tools required to treat the topic. Anyone who has heard him lecture will remember the manner in which he focuses on a topic and presents a clear and lucid explanation of the subject. He does not bother you with unnecessary details, nor does he tell you too little—his book is much the same.

Today there are at least a dozen books on the market that cover various aspects of magnetic resonance. However, they are for the most part devoted to specialized (albeit important) topics—solids, liquids or multidimensional spectroscopy. As a consequence, either these books do not cover certain fundamental aspects of the field, or they do not offer a glimpse at the breadth of material presented by Slichter. Thus, this third edition and its predecessor editions occupy a niche that has not been filled by the many excellent books that have appeared in the last few years.

In summary, *Principles of Magnetic Resonance* is an extremely valuable resource for the novice and the expert in magnetic resonance and in related fields. Mastery of the material contained between its covers will prepare one to read and understand research papers in a variety of disciplines. It presents a clear exposition of the important physical concepts underlying the field, as well as a lucid discussion of the theoretical concepts required to treat the phenomena. If I were someday to write a book on magnetic resonance, I would find it difficult to avoid using Slichter's text as a model. It has my strongest recommendation both as a text and as a fundamental reference book.

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Einstein and the History of General Relativity

Edited by D. Howard and J. Stachel
Birkhauser, Boston, 1990. 445 pp. $69.00 hc
ISBN 0-8176-3392-8

This is the first volume of the *Einstein Studies*. Volume 1 is based on the proceedings of the 1986 Osgood Hill Conference on the history of general relativity held in May 1986 at the Boston University Conference Center at Osgood Hill. Apparently this was the first conference devoted exclusively to the history of general relativity.

The book is a great pleasure to read. It contains a collection of carefully written articles by experts in general relativity and history of science. It covers roughly the period of 1907–60. The book is divided into four general sections: "Einstein's Discovery of General Relativity," with contributions by John Norton and John Stachel; "The Reception and Development of General Relativity," with contributions by Peter G. Bergmann, Carlo Cattani, Michelangelo de Maria, Jean Eisenstaedt, Peter Havas and A. J. Knox; "Unified Field Theories," with contributions by Michel Biezunski and Vladimir P. Vizgin; and "Cosmology," with contributions by George F. R. Ellis and Pierre Kerszberg.

The first section, which covers the years 1907 through 1915, begins with a fascinating discussion by Norton of the equivalence principle, explaining what Einstein had in mind and how he used his principle. This section ends with two contributions on general covariance (by Stachel) and the search for and final form of the field equations of general relativity (by Norton). Stachel describes how Einstein, in the period that immediately followed his first joint paper with Marcel Grossmann in 1913 (the *Entwurf* paper), came to the conclusion that general covariance can not in fact be a property of the gravitational field determined by the covariant field equations of gravitation. A certain restrictive choice of coordinate systems seemed to be required. This was concluded from the "hole" argument, which describes the freedom in choosing coordinates in a matter-free domain joined smoothly to the outside world. The "hole" argument turned out later not to be correct in all its aspects. It took Einstein until the end of 1915 to regain general covariance and set up the field equations of gravitation in their final form. In December 1915 Einstein wrote in a letter to his friend