

in which fully stripped lead ions with an energy of 160 MeV/nucleon were observed to change their charge after collision with a gold target. I asked Datz, "Where do the electrons come from?" He replied, "The nuclei make their own."

Yes, this field has developed because of the existence of the experimental equipment provided by the need to understand nuclear heavy-ion and high-energy physics, but ion-atom col-

lisions has now entered into a decade where its physics is truly its own. If you want to learn about this, or better yet, join in, *Relativistic Atomic Collisions* is a very good place to start. But don't leave it too long. LEAR is already dead, if not yet chopped down. When the trees go, so will the vines.

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Excitations in Liquid and Solid Helium

Henry R. Glyde
Oxford U. P., New York, 1995.
437 pp. \$95.00 hc
ISBN 0-19-851009-8

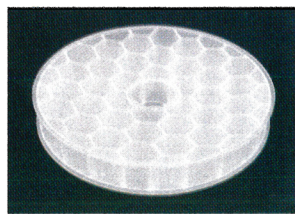
Henry Glyde's *Excitations in Liquid and Solid Helium*, number 9 in the Oxford Series on Neutron Scattering in Condensed Matter, is a fine addition to the literature. It belongs on the bookshelf of anyone seriously interested in understanding the theory of excitations in quantum fluids and solids. The book emphasizes theory relevant to an interpretation of scattering experiments. The text is presented in four sections: solid helium, liquid helium-4, liquid helium-3 and high-momentum transfer. It makes reference to some 400 original publications. The book is timely, given the recent debate and advances in measurements of the condensate fraction in ^4He and the recent high-precision measurements, including those for ^3He . In some sense, the book can be considered to be a companion volume to *Excitations in a Bose-Condensed Liquid*, by Allan Griffin (Cambridge U. P., 1993). Taken together, the two books cover excitations in quantum fluids and solids in a comprehensive manner.

In the section on solid helium, Glyde discusses single-phonon, multiphonon and interference contributions to the dynamic structure factor, and he presents a thorough description of the self-consistent phonon theory, including short-range correlations. In the section on liquid ^4He , the emphasis is on phonons, rotons and single-particle excitations, all of which can be observed through neutron scattering experiments. The treatment includes a nice discussion of the microscopic theory of the liquid and also covers the early seminal ideas of Lev Landau, Richard Feynman and the Feenberg school, including the dielectric formulation and the correlated basis function approach. In the section on liquid ^3He , Glyde develops Landau Fermi-liquid theory, reviews the microscopic basis for Landau theory provided by many-body theory and discusses various models and approximations. The final section, high-momentum transfer, includes a development of the impulse approximation and final state contributions, and a discussion of the condensate.

Although the book is in the Oxford Series on Neutron Scattering, Glyde also reviews the relevant literature in x-ray scattering. A strength of the book is that Glyde makes heavy and repeated use of experimental results from both neutron and x-ray scattering

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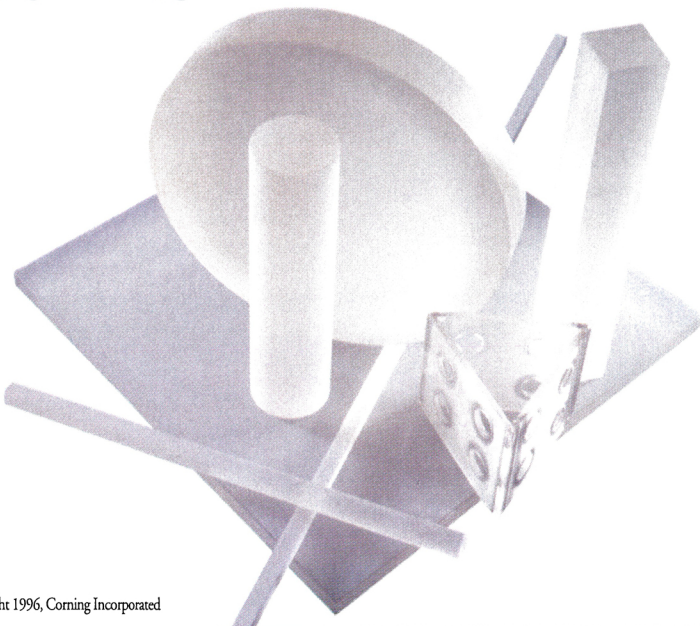
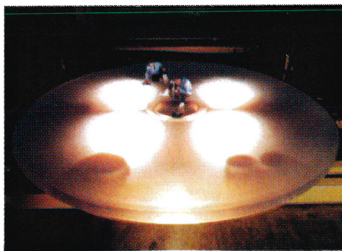
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experiments when making comparisons to theory and also when showing the present state of knowledge in a particular area. Thus the interested reader not only has a fine guide to the theoretical literature, with some emphasis on the recent theoretical approaches taken by Glyde and his collaborators, but also has an appropriate guide to the relevant experimental data base in the field.

This is a fine book. I highly recommend it to those who are entering the field, those who want a tutorial on the subjects covered and those who want a guide to the relevant literature.

ROBERT HALLOCK

University of Massachusetts at Amherst

An Introduction to Quantum Field Theory

Michael E. Peskin
and Daniel V. Schroeder
Addison-Wesley, Reading, Mass.
1995. 842 pp. \$54.95 hc
ISBN 0-201-50397-2

The absence of a comprehensive, modern treatment of quantum field theory aimed at nonexperts has for many years been a barrier to those wishing to learn the subject. *An Introduction to Quantum Field Theory* by Michael Peskin and Daniel Schroeder more than meets this need and should also provide a valuable reference for practitioners of the art.

The book is geared toward particle physics applications of quantum field theory, but connections to other areas—particularly statistical mechanics and critical phenomena—are made along the way. The overall presentation reflects senior author Peskin's calculational approach to the subject as well as his pedagogical style (which I had the good fortune to experience as a graduate student). Thoughtfully, the authors have devoted a Web page on the Internet to the cumulative correction of errors and typos appearing in their book.

The book's first section motivates the introduction of field quantization with a demonstration of the incompatibility of single-particle quantum mechanics and relativistic causality, then proceeds with free-field quantization. Feynman graphs make their appearance as a set of rules for time-ordered perturbation theory (thus emphasizing familiar quantum-mechanics methodology at the expense of more elegant but formal path-integral techniques). The scattering matrix and an introduction to radiative corrections (mostly in quantum electrodynamics) conclude this part, which stands alone as a full

semester of course material.

After an overview of path integrals and functional methods, the second section explores the systematics of renormalization of the graphical expansion. Then comes one of the great strengths of the text—two chapters on the renormalization group and critical phenomena. While comparable treatments of the perturbative evolution of couplings and operator correlation functions may be found elsewhere, Peskin and Schroeder explain their

conceptual connection to the modern Wilsonian viewpoint underlying quantum field theory. This perspective teaches us that all field theory is an "effective" or approximate description—physics at a given scale is determined by physics at smaller scales, which may have rather different field content and dynamics. Moreover, it relates scaling in field theory induced by quantum fluctuations to scaling induced by thermal fluctuations in statistical mechanics, thus bringing to

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