

coordinated and well organized. A previous book by the authors in Russian, *Principles of Nonlinear Laser Spectroscopy*, served as a starting point for the present volume in English. Although the text makes ample references to the many contributions of researchers throughout the world, the reader does get the impression that the emphasis in the book is on work performed by the two authors and their collaborators. This is not at all surprising when one considers that not only have Letokhov and Chebotayev performed some of the basic experiments in nonlinear spectroscopy but also, more importantly, they have suggested many of the concepts that have been explored by others.

The material in the book is clearly written with the same notation used throughout. The reader need not have an advanced background in quantum mechanics to follow the material; a first course in quantum mechanics will in general be sufficient. Although many aspects of nonlinear spectroscopy are available in contributed chapters in several books such as *High Resolution Laser Spectroscopy*, edited by K. Shimoda (Springer-Verlag, 1976), the present volume is the first one devoted entirely to nonlinear laser spectroscopy.

This timely book is highly recommended to students and researchers who are seriously interested in learning about nonlinear laser spectroscopy and its many applications from nonlinear optics to photochemistry.

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Progress and Its Problems: Toward a Theory of Scientific Growth

L. Laudan

257 pp. California U.P., Berkeley, 1977.
\$10.95

Ever since Thomas S. Kuhn's *Structure of Scientific Revolutions* appeared in 1962, philosophers of science have debated over scientific rationality and progressiveness with unusual vigor. As the participants achieved unprecedented sophistication, however, the lay audience for these squabbles over arcana dwindled. But now a scholar weaned on those paradigm debates promises to revive the public controversy. Larry Laudan, chairman of the University of Pittsburgh history and philosophy of science program, has written a book that shakes philosophy of science to its roots.

Laudan both destroys and creates. With detailed, scathing criticisms, he attacks the "pregnant confusions" in extant philosophies of science. The progress they espouse derives from strictly em-

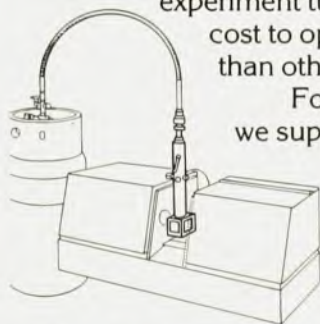
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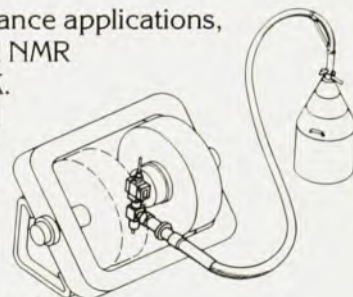
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irical criteria, he complains, and this clashes with historical evidence. Accordingly, Laudan constructs a remedy from historical examples that involves nothing less than the redefinition of scientific rationality and progress. For Laudan, "the rationality and progressiveness of a [scientific] theory are most closely linked . . . with its *problem solving effectiveness*" (page 5)—a seemingly innocuous assertion that actually vindicates countless heresies because, unlike others, Laudan distinguishes problem-solving from fact-explaining.

The innovative key to his unorthodoxy is the notion of conceptual problems, or non-empirical difficulties, that confront scientific theories. These may range from logical inconsistencies within a theory to tensions between the theory and the "well-founded" aspects of one's world view. Laudan's genius lies in his realization that inclusion of these matters in one's model goes far toward explaining historical episodes that empirically-based philosophies consider anomalous. Moreover, Laudan shrewdly observes that scientists pass judgment not on the problem-solving effectiveness of individual theories, but on *research traditions*—that is, on sets of "ontological and methodological 'do's and 'don'ts'" (page 80) around which theories are clustered. And through the mechanism of conceptual problems, variations of extrascientific beliefs *can* and *have* produced *variable* grounds for assessing such research traditions. In short, Laudan's model espouses not the elimination of rationality but its "evolving character" (page 170).

Surprisingly, after this reshuffling, science still looks like a noble—and progressive—enterprise, not a doomed, Quixotic search for "Truth" ridiculed by relativists. Far from a garden-variety positivist, however, Laudan sees science not as a pilgrimage to absolute Truth but as an evolutionary procession in which ground is given in one place and gained in another. Progress occurs through movement to more fertile real estate. One faults such a suggestive schema with difficulty.

But Laudan abuses his own creation in part 2, where he considers the "application" of the model in related fields. Having undermined traditional notions of rationality, Laudan feels obliged in this section to defend scientific progress against what he believes are its bitterest detractors—sociologists of knowledge. He endorses strongly the "arationality assumption," which posits that scientific behavior admits of a sociological explanation only in those cases in which grounds for a "rational" choice are absent. (An Edinburgh sociologist of knowledge, S. Barry Barnes, decimates this assumption in his well-known book, *Scientific Knowledge and Sociological Theory* (1974); one can understand a philosopher's ignorance of this sociological work.)

But to be "rational" in Laudan's plan, one must pick that research tradition which maximizes problem-solving effectiveness. And how does one assess effectiveness of this sort? Is solution of ten "trivial" problems better than solution of five "important" ones? "*In principle*," says Laudan, "we can determine whether our theories now solve *more important* problems than they [once] did . . ." (page 127, italics added). "*If we could show . . . that . . . one [research] tradition has been a more progressive problem solver than its competitors, then we would have legitimate, rational grounds for preferring it*" (page 192, italics added). Unfortunately, what works in principle is often tricky in practice; how one *weights* problems is *always* a critical determinant of problem-solving effectiveness—even when a "rational" choice is made. And as Laudan himself admits, problem weighting is a phenomenon which, more than most, "seems intuitively to be subject to . . . social influences" (page 222). In short, the ever-present external culture *can* influence science, even when it *is* rational.

The glory of Laudan's system is that it *preserves* scientific rationality and progress in the presence of social influence. We can admit extrascientific influences without lapsing into complete relativism. It is a shame that Laudan himself misses this. Nonetheless, his eminently readable—if execrably proofread—essay is a must for both observers and practitioners of science.

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Liquids and Solutions: Structure and Dynamics

P. Kruus

582 pp. Marcel Dekker, New York,
1977. \$45.00

The chemistry and physics of the liquid state is a vital and active field. In the last fifteen years, new developments in experimental and theoretical methods have resulted in a dramatically improved understanding of the properties of dense fluids and have led to a vast extension in the information obtainable from experimental probes. In *Liquids and Solutions: Structure and Dynamics*, Peeter Kruus presents an introduction to the chemistry and physics of liquids, suitable for senior undergraduates or entering graduate students, which emphasizes the experimental aspects of the field. Kruus, an associate professor of chemistry at Carleton University in Ottawa, has worked for some years in the application

of ultrasonic absorption methods to liquids and solutions.

The author has organized the book into three distinct sections. The first gives an introduction to the basic outlines of liquid-state theory. The emphasis here is largely on concepts useful in the interpretation of experimental results. There are, however, several inexcusable omissions. It seems inconceivable to me, for example, that any coherent presentation of the contemporary view of the liquid state can omit a discussion of the role of repulsive forces in determining the structure of a dense liquid. Yet, the author's only mention of this crucial development is a single sentence in a section on perturbation techniques, without justification or elaboration. In a similar vein, Kruus presents a classical description of critical phenomena (and later quotes some experimental critical exponents) without any indication of the ultimate failure of the classical theory or even a mention of scaling. There are, in addition, a number of serious errors in the material that is presented. One obvious example is an incorrect diagrammatic expression of the direct correlation function on page 60. Yet another is figure (3.3), which purports to show radial distribution functions for a hard sphere "liquid" but in fact gives the corresponding functions for a Lennard-Jones fluid.

The heart of *Liquids and Solutions* is really its middle section, a series of nine chapters covering a variety of experimental probes of the liquid state. This section comprises over half of the text and includes discussions of the measurement of thermodynamic and transport properties, spectroscopic methods, dielectric relaxation, ultrasonic absorption and the scattering of neutrons and electromagnetic radiation. Each chapter begins with a presentation of additional theoretical material specific to the technique under discussion, then proceeds to a discussion of experimental procedures and finally concludes with an extensive presentation of experimental results for an admirably diverse collection of systems ranging from liquid argon to solutions of macromolecules. Unfortunately, Kruus's organization of the material occasionally results in a poor integration of experiment with theory and even of one technique with another. A summary section at the end of each chapter would have been useful in helping the reader maintain a broader perspective.

The final section of *Liquids and Solutions* contains a series of brief review chapters on aspects of thermodynamics, statistical mechanics and quantum mechanics that are assumed known in the earlier sections but which include material often omitted in the undergraduate chemistry curriculum. Much of this material will be unfamiliar to a great many students, and it would probably