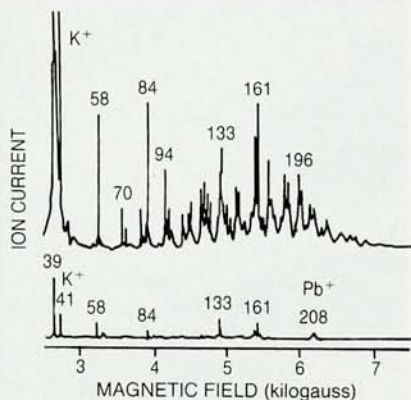




Analysis of an air sample from a room in which one cigarette has been smoked compared with normal room air. The scales are the same. The mass-84 and 161 peaks are nicotine and the level is 20 ppb. The measurement was made with a 3-inch-radius 90° magnet sector mass spectrometer with a mass resolution of 115. Surface ionization was employed using a heated Re ribbon on which a jet of room air impinged. (From W. D. Davis, *Environ. Sci. Technol.* **11**, 543, 1977; adapted from *Mass Spectrometry* by permission of the publisher.)

geochronology; atmospheric, lunar and planetary measurements; and biomedicine, toxicology and forensic science. But all the sections are eminently readable and informative. The illustrations are superb throughout.

Although mass spectrometry is almost 100 years old, many of its technical developments and applications have emerged only recently. One of the newest is accelerator mass spectrometry, which in fact celebrated its tenth anniversary in 1987 at the symposium alluded to above. However, even those of us working in this newest branch of the science may be astonished at the power and diversity of conventional low-energy (tens of keV) mass spectrometry, so ably illuminated in the book.

That mass spectrometry is a vital and growing field is demonstrated by the number and variety of new developments, such as accelerator mass spectrometry, secondary ion mass spectrometry, ion microprobes, depth profiling and molecular analysis. AMS is probably the most potentially valuable new addition to the mass spectrometry arsenal, and a whole chapter in the book could well have been devoted exclusively to it. The new developments in general are reasonably well covered, although somewhat disjointedly. Only a few subjects of importance are omitted or given short shrift. The use of AMS for measuring Cl^{36} to obtain ground wa-

ter ages (among other important applications) and for measuring certain important nuclear half-lives and cross sections is one such topic. There is also little discussion of the relative merits of negative and positive ion production in ion sources. There is no discussion of the importance of AMS for radiocarbon dating or of why no conventional low-energy mass spectrometry technique will work. These are relatively minor flaws in what is otherwise an important and timely compendium of the current status of mass spectrometry and its diverse applications.

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Quantum Theory of Collective Phenomena

G. L. Sewell

Clarendon, Oxford, 1986.

229 pp. \$55.00 hc

ISBN 0-19-851371-2

A continuing theoretical and experimental challenge is understanding our macroscopic world on the basis of its microscopic constituents—atoms and molecules governed by the laws of quantum mechanics. In its own way, mathematical physics has also struggled with this problem: What is the proper mathematical framework for the quantum mechanics of systems with very many—eventually an infinite number of—degrees of freedom? Is the dynamics of an infinitely extended system well defined? Does the system approach, in the course of time, a state of thermal equilibrium? How are equilibrium states singled out from other time-invariant states? Why is matter stable? In what sense are the laws of macroscopic physics (for example, thermodynamics, hydrodynamics or elasticity theory) a consequence of quantum dynamics?

Only a few publications address some of these questions: Gérard G. Emch, *Algebraic Methods in Statistical Mechanics and Quantum Field Theory* (Wiley, New York, 1972); Daniel A. Dubin, *Solvable Models in Algebraic Statistical Mechanics* (Clarendon, Oxford, 1974); Elliot H. Lieb's article in *Reviews of Modern Physics* **48**, 553 (1976); Phillippe A. Martin, *Modèles en Mécanique Statistique des Processus Irréversibles* (Springer-Verlag, New York, 1979); Ola Bratteli and Derek W. Robinson, *Operator Algebras and Quantum Statistical Mechanics* (Springer-Verlag, New York, 1979); and Walter Thirring, *Quantum Mechanics of Large Systems* (Springer-Verlag, New York, 1980). The

book by Geoffrey Sewell is a most welcome enrichment of the list. In fact, it has rather limited overlap with the books cited.

Sewell provides the necessary physical background while trying to keep the prerequisites at the level of graduate courses in quantum mechanics and statistical mechanics. The mathematics is as simple as possible without sacrificing rigor. For these reasons the book serves as an excellent and competent introduction to the field. The book also is a source of information for the expert.

The selection of topics necessarily reflects which collective phenomena can be studied up to the standards of mathematical physics. The static ones are phase transitions, spontaneous symmetry breaking and long-range order. The dynamic ones are mean field models with transitions far from equilibrium. The book also includes an interesting chapter on metastability. Particularly nice is the presentation of the role of the Kubo–Martin–Schwinger condition, including its connection to stability conditions.

It is easy to criticize omissions: for example, symmetry breaking for quantum ground states. But given the amount of space available, the selection of material is well balanced.

Quantum Theory of Collective Phenomena will be of interest to students and researchers in mathematical physics, theoretical physics and applied mathematics.

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Treatise on Heavy-Ion Science, Volume 5: High-Energy Atomic Physics

Edited by D. Allan Bromley

Plenum, New York, 1985.

498 pp. \$79.50 hc

ISBN 0-306-41575-5

Physics of Highly Charged Ions

R. K. Janev,

L. P. Presnyakov and

V. P. Shevelko

Springer-Verlag, New York,

1985. 330 pp. \$62.00 hc

ISBN 0-387-12559-0

Until recently, the particle beams used in atomic collision physics were usually composed of electrons or ions of lighter atoms. The more highly ionized heavier atomic species (and