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that the development is easily understood. It starts with a chapter to motivate the reader, goes through the explanation of the important concepts (paths, limit sets), offers some simple instances of equilibrium states, goes on to special methods and criteria and finally arrives at the real meat in the second half. This is the investigation of complicated schemes of equilibrium and of boundary regions between different behavior that ultimately yields the fundamental theorem for the complete description. The last chapter gives a large number of examples with detailed discussion and fascinating figures. Some elementary topology in the plane is explained in the appendix as are some of the more difficult proofs.

The field covered in this book has always been cultivated by Russian scientists, probably starting with A. M. Lyapounoff. Andronov has written books on nonlinear oscillations, and his co-authors are known for their contributions in this area. Their present work deserves the best reception. Its English translation is well printed, something that is reflected in the book's price.

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## Nuclear Fission

R. Vandenbosch, J. R. Huizenga  
422 pp. Academic, New York, 1973.  
\$29.50

The last book on nuclear fission, *The Nuclear Properties of the Heavy Elements Vol. III: Fission Phenomena* by Earl K. Hyde (Prentice-Hall, 1964), came two years before the realization that the fission barrier of many familiar nuclei contains two peaks separated by a secondary minimum. This and other recent discoveries have altered drastically our understanding not only of fission but of nuclear physics itself. There was therefore a strong need for a new text on fission, which the timely appearance of this excellent volume fulfills admirably.

The book's scope is a comprehensive account of our present understanding of fission, including both theory and experiment. Although written at an introductory level primarily for students, the book at the same time discusses recent developments in sufficient detail to make it an invaluable reference work for research scientists. The authors are experimental nuclear chemists who have participated actively in many of the experiments discussed, as well as in some of the theoretical topics considered. Their numerous previous publications include

several review articles on various aspects of fission.

The book successfully captures the spirit and activity of the renaissance that has been going on in fission for the past eight years. This renaissance has come about because of a stimulating interplay between new theoretical insight into the effects of single particles on the fission barrier and several independent experimental discoveries. The new insight provides a means of calculating the fluctuations in the potential energy of a nucleus as a function of its shape and particle numbers, in terms of nonuniformities in the single-particle levels near the Fermi surface. For some nuclei, such as those in the actinide region, these fluctuations lead to a fission barrier that contains two peaks separated by a secondary minimum. This type of fission barrier in turn accounts for three of the new experimental discoveries—spontaneously fissioning isomers, broad resonances in fission cross sections and narrow intermediate structure in fission cross sections. Other recent experimental information has indicated that the long-standing puzzle of asymmetric fission-fragment mass distributions is more complicated than had been supposed; although it is not yet completely solved, single-particle effects have shed important new light on this question also. Finally, the extra stability arising from single-particle shell closures leads to the possibility of an entire island of relatively stable superheavy nuclei near 114 protons and 184 neutrons.

These new topics are woven into a unified treatment of fission that includes practically all essential aspects. The discussion is divided into three major sections that are concerned with the transition-state nucleus, the scission configuration, and postscission phenomena. The first section includes the fission barrier, spontaneous fission, fission widths, low-lying transition-state levels, fission-fragment angular distributions, competition between fission and neutron emission, and fission-barrier heights. The second section concentrates on the motion from the saddle point to scission and on the resulting distributions in fission-fragment kinetic energy, mass and charge. The emission of neutrons and gamma rays from the fully accelerated fission fragments is discussed in the third section. The book ends with a somewhat misplaced chapter on ternary fission, which more logically could have been included in the second section.

Like most first editions, this book contains a few minor mistakes and printing errors. For example, the breakdown of the WKB approximation for small barrier heights discussed on page 57 applies only to the approxi-



mate WKB result commonly presented in textbooks and not to the exact WKB result, for which the penetrability for a general (single-peaked) barrier is analogous to that for a parabolic barrier. Also, there is no warning that the entries in Table VII-9 for  $x$  and  $y$  close to zero are substantially inaccurate, and there are small errors in figures III-8, IX-2, and XI-16.

The past few years have witnessed a fruitful interaction between fission and other branches of physics. With the development of heavy-ion accelerators that are capable of exploring other aspects of nuclear deformations, this interaction should be even stronger in the coming years. By providing an interesting and understandable account of the foundations of fission, the present volume is certain to contribute to this cross fertilization.

J. R. Nix

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## Experimental Physics for Students

R. M. Whittle, J. Yarwood  
370 pp. Halsted, New York,  
1973. \$13.25

This book is a huge compilation of about 200 experiments suitable for an undergraduate physics laboratory. The authors are R. M. Whittle, senior lecturer in physics and J. Yarwood, professor of physics, both at the Polytechnic of Central London. Its major emphasis is on classic experimental techniques in geometrical and physical optics (five chapters), thermal measurements, electrical circuits (three chapters), magnetism, nuclear physics and vacuum techniques. The experiments are part of the British undergraduate curriculum. Thus as one might expect they rely less on electronic measurement techniques and more on classic experimental measurements. Completion of these experiments provides a firm grounding in a wide variety of techniques using, for example, spectrometer, traveling microscope and cathetometer.

The compilation gives the essential description of the apparatus and theory of each experiment but beware, details on building or debugging are not treated. The latter would be an impossible task for a collection such as this. One of the best chapters in the text is the first one, "Error of Observation." Types of errors, error calculation, statistical treatment of errors, distribution, curve fitting—all these topics are treated clearly and concisely providing a valuable and quick reference for any experimentalist. Building up and per-

forming of all the experiments in several chapters such as spectroscopy and vacuum practice would provide an excellent "mini-course" (one month) for freshmen and sophomore science majors. Worthwhile practical "mini-courses" for these groups are often hard to design. For an American audience these experiments would probably not form a complete introduction to experimental physics. American physics curricula usually recognize the need for students to become familiar with current research techniques and an early introduction to sophisticated electronic devices (multichannel analyzers, versatile oscilloscopes) is an important part of our physics major. However, the goal of these experiments as stated in the book is to provide the student with a wide range of experiments and techniques, give him a feeling for errors, and to give a feeling of security with a simple measuring apparatus. The text is well written, the choice and order of experiments is excellent, and the stated goal is certainly achieved.

Many of the experiments are standard in most American teaching laboratories; however, quite a few of the more classic type in optics and mechanics are not generally known. Thus, because of the wide range of experiments, some of which are currently going out of style, the value of this book will be as a source of classic teaching experiments that one might otherwise have to hunt out of journal indices.

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## new books

### Atoms and Molecules

**High Energy Electron Scattering.** R. A. Bonham, M. Fink. 311 pp. Van Nostrand Reinhold, New York, 1974. \$24.50

### Chemical Physics

**Advances in Chemical Physics Vol. 25.** I. Prigogine, S. A. Rice, eds. 307 pp. Wiley, New York, 1974. \$22.50

**Advances in Chemical Physics Vol. 26.** I. Prigogine, S. A. Rice, eds. 317 pp. Wiley, New York, 1974. \$24.95

### Optics

**Analytical Emission Spectroscopy.** J. Mika, T. Török. 529 pp. Crane, Russak, New York, 1974. \$27.50

**Introducere in Holografie.** V. I. Vlad. 235 pp. Editura Academiei Republicii Socialiste Romania, Bucuresti, 1973.

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