The four authors are well known authorities whose combined talents cover both theoretical and experimental aspects.

The first chapter describes the theory of permittivity and loss (107 pages). It will be useful for advanced students, though not as an introduction to the subject. The reader is guided through the statistical theories of Kirkwood and Fröhlich and through the modern theories of dielectric loss. He may not, however, succeed in gaining a feeling for such concepts as the displacement current density or time correlation functions. The second chapter provides a useful account of experimental methods in 83 pages. It is followed by chapters on the dielectric properties of gases (41 pages) and the permittivity of liquids (48 pages). The final chapter is on dielectric dispersion and absorption in condensed phases (182 pages); it includes brief accounts of dielectric loss in water and ice, the Kerr effect, ferroelectrics and non-linear dielectric effects, and is beautifully written.

This is the most up to date book on this important topic; however, a few of the tables are slightly inconsistent (for example, Tables 1.1, 1.2 and 3.7), and the ten year old list of quadrupole moments on page 200 was superseded by the compilation of Stogryn and Stogryn (*Molecular Physics*, **11**, 371; 1966), and the molecular dipole moments by that of Nelson, Lide and Maryott (NSRDS—NBS10, 1967). On the whole, it is readable and clear and is recommended to advanced students and research workers.

Unrationalized units are used throughout; this seems a pity in view of the encouragement now being given to SI. Students should be warned about the most unfortunate confusion on page 10, where the fundamental equations of magnetostatics are written inappropriately—it would have been better not to have mentioned hypothetical magnetic poles and to have written the energy of interaction between two magnetic dipoles $\mathbf{m}_1$ and $\mathbf{m}_2$ separated by $\mathbf{r}$ in a medium the relative permeability μ_r of which is isotropic and independent of field strength as

$$\mu_r\mu_0(4\pi r^3)^{-1}[\mathbf{m}_1\cdot\mathbf{m}_2-3(\mathbf{m}_1\cdot\mathbf{r})(\mathbf{m}_2\cdot\mathbf{r})r^{-2}]$$

in rationalized units (and 4π times this in unrationalized units), where μ_0 is the permeability of a vacuum. At a point $\mathbf{r}$ from $\mathbf{m}$, the magnetic potential $\varphi=\mathbf{m}\cdot\mathbf{r}(4\pi r^3)^{-1}$, the magnetic field $\mathbf{H}=-\nabla\varphi$, and the flux density $\mathbf{B}=\mu_r\mu_0\mathbf{H}$. The units of m are Am^2, and in SI $\mu_0=4\pi\times10^{-7}$ $Js^2C^{-2}m^{-1}$.

A. D. BUCKINGHAM

CLUSTERING PHENOMENA

Clustering Phenomena in Nuclei

(Invited Lectures and Contributed Papers from the International Conference held in Bochum, 21–24 July 1969. Proceedings Series.) Pp. 354. (International Atomic Energy Agency: Vienna; HMSO: London, 1969.) 259 schillings: 83*s* 4*d*; $10.

THIS book contains the proceedings of the first international conference wholly devoted to the subject of clustering phenomena in nuclei. The conference was attended by 170 physicists including large groups from Germany and the Soviet Union, but had very few participants from Britain.

The invited papers are rather short by the standards of many recent conference reports, but nevertheless give a valuable, and generally lucid, description of the application of the cluster model in the study of nuclear scattering and reactions and of the properties of bound states. A particularly attractive and welcome feature in several of these papers is the historical discussion of the development of the cluster model, from the resonating group approach of Wheeler to the generalization of the variational techniques developed by Wildermuth and collaborators at Tübingen and the Young diagram techniques used by Smirnov and other Russian workers. There are also several reviews of the experimental situation, particularly relating to quasi-elastic knock-out and break-up reactions.

The contributed papers are rather brief, but serve to give an impression of the wide range of nuclear properties and processes which have been interpreted in terms of clustering.

Sceptics may doubt whether the rather simple ideas which form the basis of the cluster model can lead to a sufficiently sophisticated description of nuclei and their interactions. The conference report is, however, attractive and stimulating, perhaps because it represents the views of a group of enthusiasts, and can be recommended on this ground alone. More importantly, it deserves serious attention because it deals with a branch of nuclear physics in which there is at present little interest in Britain but which may become of much greater interest if current proposals for a heavy ion accelerator are accepted.

DAPHNE F. JACKSON

GENERAL RELATIVITY

Essential Relativity

Special, General and Cosmological. By Wolfgang Rindler. Pp. xi + 322. (Van Nostrand Reinhold: New York and London, January 1970.) 107*s*.

HERE is a new book on general relativity with a welcome emphasis on the ideas of the subject rather than with slogging out the mathematics. It is an attempt to bring the full range of relativity within reach of advanced (American) undergraduates, but the author contrives to include only new material and to simplify some of the standard arguments so that the teacher shall not be bored either. The book can be started by a student who is familiar with partial differentiation, oridinary vector calculations and a little elementary algebra. What is needed beyond this is developed as the book progresses. The idea of a 4-dimensional formulation is introduced a quarter of the way through, and the tensor calculus is slipped in unobtrusively about half-way and only to the extent that it is needed.

The author makes a serious attempt to alter the order of presentation. After a brief introduction to Newtonian mechanics, electrodynamics, Mach's principle and the principle of equivalence, he then proceeds to set special relativity into its context of the equivalence principle and Mach's principle. There is everything to be said for this point of view compared with the conventional one in which the reader is first of all taught the wrong frame of reference and then shown its difficulties and asked to reconstruct all his ideas from the beginning. The crucial step to general relativity occurs in paragraph 49 headed "Why gravity does not fit in to special relativity". I found this paragraph the least satisfactory in the book. Essentially, the author believes that the equivalence principle is what excludes gravity from special relativity. It is surely truer to say that a special relativistic theory of gravitation cannot include the equivalence principle to a greater extent than Newtonian gravitation did (though, of course, even nineteenth century textbooks on mechanics include it implicitly in the fact that the chapters on central forces all work with force and energy per unit mass). This is, however, a somewhat pedantic objection to a very satisfactory grand plan. The second half of the book deals with general relativity and cosmology and the book ends in a rather splendid manner, as it began, with Mach's principle. Einstein is here compared with Columbus from the point of view of incorporating Mach's principle; general relativity is seen as a magnificent failure which has none the less produced many worthwhile side products.

The author is not afraid when necessary to give a rough argument which includes good understanding first, followed by a more formal one afterwards. In this way he has produced an eminently readable book which has been well printed with a good index.

C. W. KILMISTER