Shedding light

The Theory of Polarization Phenomena. By B. A. Robson. Pp. viii+119. (Clarendon : Oxford; Oxford University Press : London, January 1975.) £5.50.

THIS book is one in the series of monographs *Oxford Studies in Physics.* It comprises just over 100 pages and contains only 40 references in its bibliography. It is therefore very selective in its material and is likely to be narrow in its range of utility. On the other hand, although a vast number of experimental measurements have been obtained there is a paucity of coherent theoretical treatments, so any light (polarised or otherwise) that can be shed on the subject is welcome.

The content of the book is aimed at the gap between undergraduate treatments and research review articles, and it will undoubtedly have most value for new researchers in the field. Starting from a classical basis, the book develops both the Jones and Mueller calculi. The comparison between the two is most valuable. The generality of the Mueller calculus which uses observable quantities and does not rely on the electromagnetic theory of light makes for a powerful and pragmatic description but the Jones calculus has an appealing simplicity for application to coherent beams and polarised light.

Assuming a background knowledge of quantum theory and matrix mechanics, the author develops the quantum theory of polarisation and then gives separate sections on spin $\frac{1}{2}$ and spin 1 particles in the non-relativistic limit. These treatments will be of increasing value as polarised beams of deuterons and other ions become available. The generalisation to the cases of arbitrary spin and polarised targets is of intrinsic value in view of the advent of superconducting magnets. Further sections include the emission and absorption of electromagnetic radiation and an indication of how to include relativistic effects.

Although my overall impression is of a neat and concise presentation, the complete absence of any experimental considerations will perhaps limit the ultimate value of this book. The few diagrams are of vectorial representations or of energy level schemes which leave much of the physical, three-dimensional aspects of the subject to the imagination.

What is now needed is another monograph to explain the physical meaning of this erudite formalism.

Richard J. Griffiths

Animal ultrasound

Ultrasonic Communication by Animals. By Gillian Sales and David Pye. Pp. x +281. (Chapman and Hall: London, September 1974.) £4.95.

THERE are good physical reasons why the wavelengths, and inversely the frequencies, of sounds generated and received by animals should be related to the size of those animals. Thus, it is no surprise that some of the smaller mammals use ultrasound in communication in the same ways that larger animals use sounds audible to man. But in addition to that a new field is opened up because those shorter wavelengths allow a much stronger interaction with the environment. Some of the technical feats involved in the use of ultrasound are truly remarkable: in addition to the echo-locating behaviour of bats there are a whole variety of evolutionary adaptations such as the ultrasonically silent aerodynamics of the owl, the ingenious sound generating mechanisms of insects such as grasshoppers, crickets and some species of moth, and the recent and varied developments in moths to detect and avoid bats, newcomers on the evolutionary scene.

Bats themselves produce a wide variety of signals depending on species and circumstances. Undoubtedly, the details of these will intrigue the technically minded reader, and those less technically minded will find the introductory sections of the book useful in explaining ultrasound, its interactions with obstacles, and its detection. It is only fair to point out, however, that only half of the material will interest such a reader. The remainder is clearly intended for the biologist and behavioural scientist.

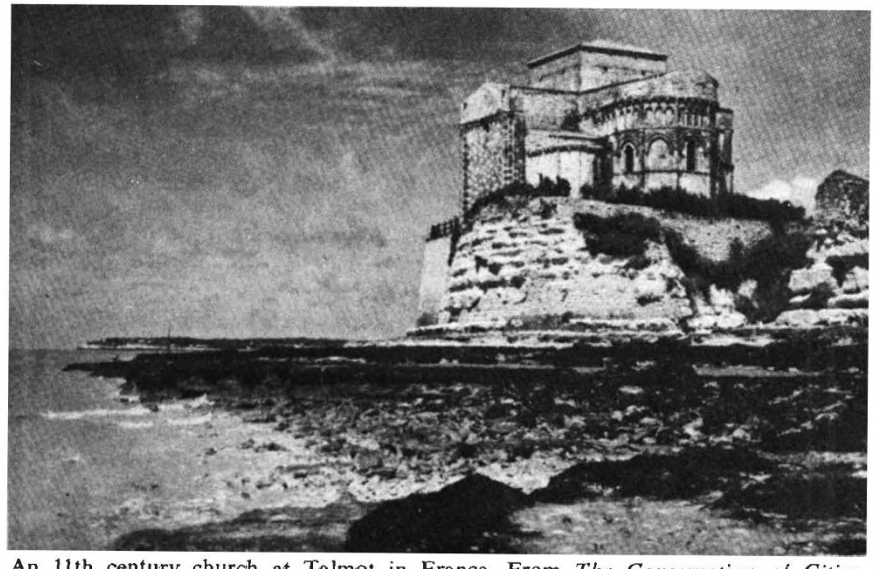
It might be argued that echo-location or navigation by sound is not communication and that the attempt to combine this with true communication leads to difficulties. It seems very arbitrary, for example, to limit discusson of communication between animals to a consideration of ultrasonic frequencies. Presumably, an integrated consideration of *all* sounds audible to the animals concerned, and comparison with other species not using ultrasound, would give much greater insight into the subject.

Such limitations are less obvious on the echo-location side as it is necessary to use the short wavelengths of ultrasound to detect small objects. In any case, the authors discuss examples of navigation using audible frequencies by the oil bird and cave swiftlet. One of the problems which faces the authors is the large number of species which have been researched, each with subtle variations in signals and behaviour, so that a comprehensive picture inevitably becomes repetitive.

The book naturally emphasises the authors' interests: bats, rodents, crickets and related insects. They devote much less attention to marine animals which indulge in reasonably sophisticated communication and rival in some respects the navigational abilities of bats. An area which stands out for future investigation is passive echo-location using ambient sounds which could in principle be much more effective at ultrasonic frequencies for small animals than for the blind man.

Generally, the photographic and line illustrations are adequate, but the oscillographs and sonograms have reproduced poorly and are not helped by the inartistic patterns of black masking. The book is well referenced and contains a wealth of information on animal signals that have only recently become accessible to man. Perhaps other readers like me will be tempted to construct bat detectors of their own.

J. P. Wilson



An 11th century church at Talmot in France. From *The Conservation of Cities.* Published as a contribution to European Architectural Heritage Year. Pp. 186. (Croom Helm: London; UNESCO: Paris, 1975.) £4.95.