

Lasers for the Masses

Lasers. By O. S. Heavens. Pp. 159. (Gerald Duckworth: London, September 1971.) £3.25 cloth; £1.25 paper.

The Basic Theory of Lasers and Masers. A Density Matrix Approach. By Jacques Vanier. Pp. xii+115. (Gordon and Breach: New York and London, October 1971.) £4.75 cloth; £2.25 paper.

If it is unfair any longer to describe the laser as a solution searching for a problem, it might not be too unfair to describe many of the books offering to give a general introduction to the laser as answers searching for a questioner.

Unfortunately, Professor Heavens's new book seems to fall into this category. An introduction for the reader "with only a limited knowledge of science", it begins with a brief outline of the nature of light and light sources, and "how things behave when exposed to light". This last covers not only a classical discussion of the properties of reflecting and transmitting media, but also effects in crystals, polarization and the electro-optical effect. There follows a short introduction to quantum phenomena and stimulated emission. These chapters give the impression of a breathless rush around a very wide topic, and one suspects that for the "non-scientific" reader they will raise many more questions than they answer. The sections on lasers are more satisfactory. Perhaps because of delays in publication, however, they tend to devote much more space to ruby and helium-neon lasers than to those such as carbon dioxide and dye systems which may well be more important in the near future. The discussion of the difference between laser and ordinary light is confusing because it runs together ideas about classical coherence and photon counting with the mode structure of the laser beam. The section on applications is surely much too brief for the general reader. Holography is well treated, but cutting and welding, one of the most common topics of interest to lay audiences, is dealt with in a very cursory manner, as are ranging and measurement devices.

This book seems most suitable for that "Abominable Snowman" the educated (and well-off) layman who has the time and inclination to dabble in a little nonmathematical science. Schools may well find the price prohibitive, although the readability of the style makes the book attractive. A final point of importance, if it is intended for school and college use, is that the suggestions for further reading are woefully inadequate and out of date. Obviously, a book of this level would not be expected to give numerous

references to original research, but any reader wishing to follow up a particular topic at a slightly higher level would find Professor Heavens's reading list very unhelpful.

The Basic Theory of Lasers and Masers, in the Documents on Modern Physics series, has a rather misleading title. In fact, this monograph gives a very clear and concise introduction to the density matrix formalism as applied to a range of quantum mechanics problems. Lasers and masers are brought in merely as an illustration of one of the uses of the technique and one is forced to the conclusion that the title was chosen with an eye to salability. With a hard-cover price of £4.75 for a hundred and fifteen pages, the book no doubt needs all the help it can get, but this should not be allowed to detract from its merits.

The density matrix technique, in which an ensemble of identical particles can be described by a unique matrix, is finding wider and wider application in a number of fields of physics. At the moment, perhaps the most interesting area is that of coherent interactions, and this book gives an excellent introduction to the necessary theory. The theoretical level is such as to be accessible to anyone who has gone through a good, present-day undergraduate course in quantum mechanics, and experimental physicists should be able to gain a considerable amount from the analysis and examples. The bibliography has a number of rather surprising omissions, but is adequate.

Both these books have something to offer in the laser field, one at the bottom and the other at the top of the scale of sophistication. However, one must ask how long this spate of beautifully produced but highly priced volumes can continue, especially those which are at best peripheral in value, without the bankruptcy, or at least disillusion in the physics market, of a number of publishers.

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Desert Culture

The Negev: The Challenge of a Desert. By Michael Evenari, Leslie Shanan and Naphtali Tadmor. Pp. x+345. (Harvard University: Cambridge, Massachusetts; Oxford University, London, July 1971.) £7.25.

THE remains of well organized and extensive civilizations in desert regions have provided subjects of study and speculation for well over 100 years. Archaeologists have been foremost in these studies but geographers, agriculturalists and ecologists have also produced their theories on how such elaborate communities have been supported by apparently scanty resources. As far as I know, however, only Pro-

fessor Evenari and his co-workers have attempted to test their hypotheses on the functioning of ancient desert agriculture, by reconstructing the system. Working in the Negev, the authors enlisted the assistance of an archaeologist, geologist, and zoologist, and with generous financial aid from the Ford Foundation, Rockefeller Foundation, the Rothschild Memorial Group and a number of private donors, were able to undertake the necessary studies eventually to reconstruct two ancient farms. The basic surveys that led up to this, the story of the reconstructions and the subsequent scientific work are described in this book.

The result is quite fascinating and, on the basis of carefully collected experimental data, challenges many of the theories previously held about the mode of operation of ancient agricultural systems. For example, one of the most intriguing features of the extensive ancient ruins of the Negev is the occurrence of thousands of stone mounds that are found over the area, often in association with ancient towns. In aerial photographs they show up as an extremely regular feature, often accompanied by gravel strips and in proximity to ancient fields that receive run-off water from the mound and strip-covered slopes. One theory was that they were sites for vine-culture; another, that they might have been connected with dew condensation and water supply. Professor Evenari and his associates reject these hillside-agriculture theories and suggest an explanation in terms of valley agriculture. On the evidence of experimental run-off plots it is shown that clearing the stones and gathering them into mounds increase the annual run-off. This in turn can be utilized for agriculture in the valleys which mainly relies on this source of moisture.

The agricultural results are impressive. Field crops, vegetables, medicinal and pasture plants, as well as a number of orchard crops were grown successfully. The chapters describing this work provide a wealth of information on crop physiology but the subsequent chapters on the adaptation of natural plants to desert conditions contain much information previously published elsewhere.

The authors see the ability of Israel to meet the challenge of its deserts as a measure of its final success and permanence. Not surprisingly the method of management practised by the Bedouin comes in for some criticism. But, if the decline of desert agricultural systems in the past has resulted from exploitation at a higher level than the ecosystem can endure over a long period, perhaps, after all, the nomadism of the Bedouin could represent one well-adapted method of long-term utilization of the desert resource.

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