

Microwave spectroscopy

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Modern Aspects of Microwave Spectroscopy. Edited by G.W. Chantry. Pp. 513. (Academic: London and New York, 1979.) £38.80, \$89.50.

YET another expensive volume containing articles by several authors! I have never been totally convinced that this is a satisfactory way to publish reviews. Such books often suffer from one or more of three main defects: the material tends to be three or four years out of date on publication, the various chapters may be uneven in quality and balance, and finally, more often than not, many chapters are intrinsically re-hashes of previously published reviews, often by the same authors. On the whole this book is better than average on these three scores and, indeed, microwave spectroscopy is one of the few areas for which there does not exist a surfeit of such books.

The first chapter, "Microwave Spectrometers" (G.W. Chantry and G. Roussy), gives rather brief general descriptions of various experimental techniques which are used to carry out microwave spectroscopy. Although it gives a useful overview I felt the chapter was too short to cover microwave hardware in sufficient depth. The technical aspects are important as microwave spectrometers are no longer commercially available. The chapter has a comprehensive compilation of references.

The second and third chapters are entitled "Microwave-Microwave Double Resonance" (J.G. Baker) and "Infra Red-Microwave Double Resonance Techniques" (H. Jones), respectively. Both are very useful, detailed reviews of the double-resonance method. They complement each other well and are presented at about the right level. The latter includes a section on optical-microwave experiments and so the two chapters, taken together, give a quite comprehensive survey of a technique which has revolutionized high-resolution molecular spectroscopy.

The fourth chapter on modern submillimetre microwave scanning spectroscopy, by A.F. Krupnov, highlights recent advances in the automation of the beautiful wide-band millimetre wave scanning spectroscopy technique pioneered by this author. The techniques described here would be useful were they available to the scientific community. However, the direct experimental value of this chapter is limited because the necessary high-power microwave sources appear only to be available in the military installation at Gorki in the USSR.

Chapter 5, by J.W. Fleming, deals with interferometric spectroscopy at millimetre and submillimetre wavelengths. Although

this is a useful review of the technique, I find it a curious choice for this collection, though it does give a welcome change of pace. I suspect that the audience for the other articles is biased towards higher resolution techniques and that this review may not be readily found by those to whom it would be most valuable.

The last contribution is yet another review on interstellar molecules, entitled "Astrophysics of Interstellar Molecules" (G. Winnewisser, E. Churchwell and C.M. Walmsley), and it is valid to ask whether another review is justified. This one is. It

presents a different perspective as it is more strongly biased than previous reviews towards spectroscopy — as is appropriate for this volume. It is well balanced and covers the appropriate material comprehensively from a microwave spectroscopists point of view. In addition it is up to date with numerous useful tables.

In all, this is a timely volume for the practising microwave spectroscopist. □

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A weather controversy

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Weather Modification. By G. Breuer. Pp. 178. (Cambridge University Press: Cambridge, UK, and New York, 1980.) Hardback £10.50; paperback £3.75.

WEATHER modification is an emotive subject among meteorologists, and over the past few decades there has been a great deal of controversy. The physics and dynamics of atmospheric phenomena are more complex than most physical systems and, more often than not, incompletely understood. However, the potentially significant social, agricultural and economic rewards of successful weather modification have ensured that a considerable amount of financial backing has been available for experiments, often in the absence of sufficient scientific knowledge. The 'seeding' of clouds by silver iodide crystals to enhance rainfall is one example of how a laboratory technique was applied to real atmospheric clouds before a quantitative knowledge of the physics and dynamics of these systems was available. This book illustrates the basic gulf between the practical application of simple techniques to control complex dynamical systems, with a considerable number of commercial, political and economic consequences, and the background of insufficient theoretical understanding. It is no surprise that debate exists with such contrasting motivations surrounding the subject.

The book, in three chapters, is generally well written and is informative to the non-specialist, and the above-mentioned gulf between theory and application is well documented. It is not intended for the specialist, who might be irritated by the large amount of speculative science and continual reference to political and military application; this is especially true of the last chapter. However, the extensive bibliography is useful to both specialist and non-specialist. In general, a balanced viewpoint on a highly controversial topic is

retained, and the layman should obtain much useful information.

The first chapter provides a background largely dealing with the philosophy and history of the topic, and brings out the controversies of the subject, particularly that related to cloud seeding. The introduction to the basic physics is unfortunately rudimentary and out of date. The reader may be left with the mistaken impression of cloud physics and dynamics being a very inexact science; recent advances in computational and mathematical techniques are not considered and the cloud models are typical of those seen in school textbooks. An important aspect stressed is the inadequate statistical significance tests in most cloud-seeding experiments, recognized as a major criticism of the subject in general.

The second chapter is undoubtedly the most quantitative and scientific; subjects such as fog dispersal, seeding of convective and orographic clouds, hail and lightning suppression, and the modification of hurricanes are discussed. The author covers experiments in many countries, mainly the USA, USSR and Australia. An interesting historical review of the basis of cloud-seeding, beginning with Langmuir's first laboratory experiments and the initial euphoric and extravagant claims made about weather control, is included. The seeding of cumulus clouds is reviewed in some detail, but the seeding of orographic clouds has probably been the most successful and has the best history of controlled scientific experiment, especially in the USA. It is no surprise that the modification of hurricanes has achieved little success since the basic dynamics, particularly in the growing stages, are not well understood. The most speculative discussion is centred on the modification of large-scale weather systems and climatic change. This has not yet been deliberately attempted, although man-made effects, such as carbon dioxide production due to industrialization, affect climate although their importance is debatable. The possible causes of climatic change are not reviewed in any detail, but these are also beyond the scope of the book. The economic and political interests in weather modification, particularly in cloud seeding, are des-