

Townes C H & Schawlow A L. *Microwave spectroscopy*. New York: McGraw-Hill, (1955) 1965. 698 p.  
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The 1965 edition is a systematic treatment of the theory of microwave spectra of molecules and atoms and of the experimental techniques used. A full bibliography of the field during its first decade, tables of molecular constants pertinent to their microwave spectra, and tables of certain other functions useful to microwave spectroscopists are included. [The SCJ® indicates that the 1955 and 1965 editions have been cited in over 2,635 publications.]

## A Text and Summary of the First Decade of Microwave Spectroscopy

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High-resolution microwave spectroscopy was initiated immediately following World War II, after a number of physicists had become well acquainted with microwave techniques from radar development. I was one of them, and being in on the beginning of the field, I was able to follow it rather completely for some time. The decade following initiation of the field was a busy and exciting one, with the enormous increase in spectral resolution over normal types of spectroscopy, the precision of frequency measurements, the completeness with which theoretical explanations could be worked out, and applications of the new field to important molecular, atomic, and even nuclear problems. The maser and laser also came out of the increased contact with and understanding of radiation processes that grew from such research.

Initial contributors to the field were physicists, particularly those oriented towards electronics, but research efforts spread rapidly to chemists because of its obvious bearing on molecular structure; and they contributed an ever-increasing amount as the decade developed. The field was intensively pursued and it developed rapidly.

By 1948 I had moved from Bell Telephone Laboratories to Columbia University and had the privilege of working with a number of very capable students and postdoctoral scientists. My aim at that time was to explore all the more important potentialities of the field, to understand the theoretical fine points as well as could be done at that time, and to push each type of measurement as far as possible towards sensitivity and precision so that high precision physical measurements could be made and theoretical ideas tested. One of my important colleagues was Arthur L. Schawlow, who joined me at the

Columbia Radiation Laboratory in 1949 after completing a thesis in spectroscopy at the University of Toronto. By late 1950, when I felt the time had come to start a systematic treatment of microwave spectroscopy, it was clear that Schawlow would be an ideal coauthor and fortunately he agreed to collaborate on the project.

The book started as a series of manuscript pages used in a class that I taught for physics graduate students. The manuscript soon made an impression on me, because one irate student used it to pound me on the head! Not so long after we were well started on the book *Microwave Spectroscopy*, I faced a three-year term as chairman of the Department of Physics beginning in 1952 and then a sabbatical leave at the end of the 1954-1955 academic year. In principle, that fitted logically into my own thinking. I believed that by 1955 microwave spectroscopy would be a mature field for physicists, although one that chemists would continue to exploit and develop for a very long time, and hence that it was time to produce a reasonably complete treatise on the subject. I hoped it would provide a good basis for others who would enter and extend the field. After that, I would think during my sabbatical in 1955-1956 about other areas into which my research might move. Application of molecular microwave spectroscopy to astronomy, a branch of the field that burst into flower later and on which I have spent some time, received only brief speculation in the book.

As things developed, Schawlow moved to the Bell Telephone Laboratories but was able to come to Columbia almost every weekend, so we could jointly work on completing the treatise. Thus, the final phase of completion, just in comfortable time for printing before I departed on a sabbatical leave in Europe, was a nights and Saturdays enterprise.

We wanted to cover the field as thoroughly as could be done at that point, giving references to every paper published in the field, a list of all molecules and parameters that had been measured, and reasonably complete tables of information peculiar to the field. We also aimed for as rigorous a theoretical treatment as practical so that, even though the field might be pushed somewhat beyond aspects of interest in that period of time, the treatment would not grow out of date too fast. In addition, we decided to give some systematic treatment of experimental techniques—of the book's contents it is perhaps only some of these techniques that have now become dated. In undertaking and organizing the book, I certainly had in mind the excellent books on molecular spectroscopy that Herzberg had produced and that had been so useful to us and to other molecular spectroscopists. However, the field of microwave spectroscopy was different, much newer, and hence we felt was appropriately treated with somewhat more integration of theoretical and experimental discussion.

I am delighted that microwave spectroscopy has continued to grow and flourish as a field,<sup>1,5</sup> particularly in chemistry as we had expected, and that our efforts to obtain a reasonably complete and balanced treatment have proved to be useful to the community. I still sometimes find it useful myself.

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