

SYMPOSIUM ON SPECTROSCOPY

held at

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FOREWORD

THIS year of 1944 comprises the sixty-second anniversary of spectroscopy. Such a statement might well be disputed if applied to the concept, but scarcely if applied, as I intend, to the word; for Sir Arthur Schuster has attested that in his belief he was the first to use the word, and for it he has given the birth-date of 1882. We are therefore celebrating the sixty-second birthday of spectroscopy as a word by holding this Symposium, and also by instituting in the American Physical Society a Division of Spectroscopy to cherish the word and the concept henceforward.

Spectroscopy pertained at first to visible light and to what we now call the "near" infra-red and the "near" ultraviolet. As the realms of the infra-red and the ultraviolet broadened out, spectroscopy kept pace with them, spreading even into the field of x-rays and beyond. Not content with this expansion of its territory, the word overleaped the barrier between radiant energy and ponderable matter. We speak of the beta-ray spectra of radioactive substances, and we speak of mass spectroscopy applied to analyze the isotopic constitution of the elements and the molecular constituents of mixtures of gases. One sees whither the word is tending. *Spectroscopy is classification*: that is the asymptote which the meaning is approaching. Optical spectroscopy is classification by wavelength; electron spectroscopy is classification by momentum; mass spectroscopy is classification by rest-mass. The art of the spectroscopist consists in sorting out the classes and identifying them.

No such breadth of meaning is embodied in the programme of the Symposium nor contemplated in the plans for the Division. We have confined the scope of the former to optical spectroscopy, and shall probably confine the scope of the latter not much less narrowly. What we lose in breadth we however gain in depth. Spectroscopy as a science comprises not only classification but also explanation. Explanation in optical spectroscopy has been more successful than in any other field of physics. To the spectroscopy of black-body radiation we owe the quantum theory in its earliest form, and to the spectroscopy of the light from atoms (with invaluable assistance from the scattering of alpha-particles) we owe the Bohr atom

model and we owe wave mechanics. Wave mechanics, having sprung from the analysis of the simplest of atomic spectra, has amply repaid its debt by interpreting even the most complicated; and atomic mechanics in its field seems hardly less triumphant than celestial mechanics in its own.

The greatest part of optical spectroscopy is subdivided into the study of line-spectra characteristic of atoms and the study of band-spectra characteristic of molecules. Line spectroscopy gives the impression of being a nearly completed science, as a French physicist, Biot or another, said of the whole of physics about 1820. I should not venture such an impolite remark, were it not that in the history of physics such statements are generally remembered through being proved conspicuously wrong; and I anticipate that the appearance of this one in the *Reviews of Modern Physics* will soon be followed by its confutation, though I shall not claim a causal relationship. Band spectroscopy has not advanced so far, and it seems to be menaced by a different danger. Everybody has heard to satiety the bitter saying that the progress of scholarship consists in more and more being known about less and less. The progress of band spectroscopy however seems to the outsider to consist in more and more being known by fewer and fewer. Considering the difficulty of the field, I do not see how to avert this fate.

It will be noticed that in this Symposium two fields are relatively well represented, that of band spectroscopy and that of the spectra of the heavenly bodies; others very scantily, and others not at all. For the benefit of future generations be it stated that omission of a topic is not to be taken as meaning that in 1944 the topic was obsolescent; usually it means that those who used to cultivate the topic were strenuously occupied in war work in these unhappy days, and could not spare the time even to narrate their earlier researches. One field which for this reason and only for this reason is here unrepresented is that of the applications of spectroscopy in chemical analysis. It remains to record that R. S. Mulliken, H. H. Nielsen, and O. Struve were the chief architects of the Symposium.

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