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VICTOR SCHUMANN

By THEODORE LYMAN

Victor Schumann was born near Leipzig in the year 1841. He received his early education at Leipzig and later, from 1860 to 1864, he was at the Gewerbeschule at Chemnitz. It must have been during this period that he acquired that extraordinary mechanical technique which characterized all his scientific work. For a time he was employed as a designer by Hartmann & Zimmermann; later he was engaged in the manufacture of machinery for the book industry; finally, he became a partner with Mr. A. Hogenforst in the machine business in which he remained actively engaged until 1892 and by means of which he was able to accumulate the funds which he spent in scientific work.

He was more than forty years of age before he was able to turn from his business to scientific pursuits. Even then, his investigations were conducted in the evening or at such odd times as he could spare from his regular profession. Photography first attracted him; one of his earliest papers, published in 1885, is on the sensitization of photographic plates. Almost immediately after this, however, he took up the pursuit of spectrum analysis, to which he devoted himself for the remainder of his active life. His first paper on the spectrum of hydrogen and upon the effect of the presence of impurities on the spectrum of mercury appeared in

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1886. He must have been inspired by the idea of penetrating into the region of the extreme ultra-violet very early in his scientific studies, for it was but four years later that the article which marks the beginning of his attack on the region of the most refrangible rays appeared. Guided by the work of Stokes, Soret, and Miller, he began by instituting a very careful comparison of the relative advantages of fluorite and quartz, and, becoming convinced of the superiority of fluorite as a transparent medium for rays of the shortest wave-length, he employed this substance for his prisms and lenses. Thus equipped, he followed the spark spectra of more than twenty metals to the region λ 1820. He next set himself the problem of determining the factors which caused the common limit in the spectrum of so many substances. His knowledge of photographic phenomena led him to recognize the part played by the absorption of gelatine, while his familiarity with the work of Cornu drew his attention to the absorption of the air. He put these ideas to the test by the construction of a vacuum spectroscope and by the use of special photographic plates whose emulsion was nearly free from gelatine. His efforts were almost immediately crowned with success, for a very considerable extension of the spectrum followed the use of the new apparatus. Brief accounts of this work appeared between 1890 and 1893, while a more detailed description of these researches was published in the *Proceedings* of the Vienna Academy in the latter year. It was during this period that Schumann gave up his business interests to devote himself entirely to his spectroscope. During the next ten years he went steadily forward, accurately and surely adding to his methods one improvement after another as the results of experiments showed the way, until he finally arrived at the limit of the spectrum set by the absorption of fluorite near λ 1200.

But as early as 1897 his health began to give way. Never of a robust constitution, he had submitted to considerable privations in early life in order to obtain the funds for the purchase of books. He undoubtedly still further undermined his constitution by the arduous labors entailed in the construction of his apparatus. In 1903 he was forced to give up nearly all experimental work. He died on September 1, 1913.

Many of Schumann's results are to be found summed up in the *Smithsonian Contributions to Knowledge*, No. 1413. His first considerable contribution to science was the investigation of the absorption of the air. The existence of the region which bears his name having been once established, he set himself to study the absorption of a number of gases and demonstrated that it was to oxygen that the high absorbing power of the air was due. He next proved that hydrogen possessed great transparency in the most refrangible region and made use of this fact to improve the action of his spectroscope by flushing the interior with this gas. On turning his attention to emission spectra, he obtained valuable information on the radiations from oxygen, carbon monoxide, carbon dioxide, and nitrogen; but it was in the study of the spectrum of hydrogen that his finest results were obtained. He showed that this gas possessed a multitude of lines extending from near λ 1650 to the limit set by fluorite, and by great technical skill and keen experimental insight he succeeded in producing spectrograms of hydrogen which probably will never be surpassed for definition and finish.

Labor spent in the extension of human knowledge is never wasted, no matter how remote from active human interest the field of such labor may appear. The work of Schumann is a brilliant example of the truth of this statement. For the region into which he penetrated reveals day by day to those who explore it greater and greater possibilities for results of fundamental scientific importance. The biologist may watch wonderful changes in living organisms if he will illuminate the field of his microscope with the extreme ultra-violet rays from a hydrogen tube; the student of spectral series may find the key to his fascinating problem on the more refrangible side of λ 1500, and the mathematical physicist who seeks to verify the quantum theory by photo-electric action will find an important test for his hypothesis in the Schumann region.

It has been said that genius consists in an illimitable power of taking pains. Schumann's genius belonged to this character, but the observer who, having marveled at the intricate construction of his spectroscope, obtains the impression that its mechanical perfection represents the highest mental attainment of its maker

entirely misses the truth. Schumann took up the pursuit of science at a time of life when initiative and perseverance in most men are no longer active qualities. The extent of his studies was cut short by the failure of his health. It was never given to him to explore thoroughly the promised land which he discovered. But Schumann possessed the mind of the true investigator; his inductive reasoning was without a flaw. What he did, he did excellently. The final results of his labors are established so firmly that they will never be shaken.

JEFFERSON LABORATORY
HARVARD UNIVERSITY
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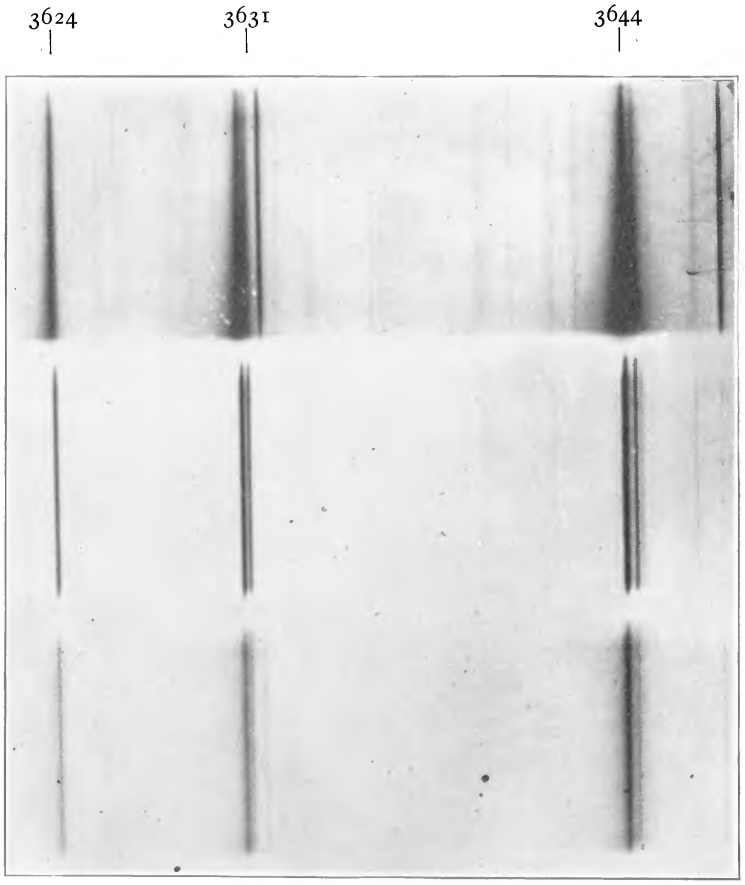
PLATE I



CALCIUM TRIPLET AT λ 3644 RESOLVED ONLY AT LOW PRESSURE