PREFACE

100 Years of X-rays

On 8th November 1895 the German physicist Wilhelm Conrad Roentgen discovered a new kind of rays while dealing with his research work at the Physical Institute of the University of Wuerzburg. Firstly he called them “X-rays”. Later, after a lecture, held by Roentgen to the Physical-Medical Society Wuerzburg, the Professor of Anatomy, A. von Koelliker, suggested, to call the new rays “Roentgen-rays” in order to honour Roentgen—a term which is common in the German-speaking area.

W. C. Roentgen is considered the best experimental physicist of his time. He did not leave it at the mere discovery of a new physical phenomenon, but he began at once with an intensive research of all physical characteristics of the new rays. For such research work Roentgen was the unmatched master in his field. He possessed the ingenious characteristic to provide all experiments in such a way that only the essential part, which was important, could be observed. Thus they were, according to the physicist, free of all dirty effects. Within few weeks he had already gained a fundamental overall view of the characteristics of the new rays and started writing a manuscript, which was already available and distributed at the end of December 1895. In two further research reports—besides, all others had only few pages—Roentgen published new results of the research of the X-rays.

At first it were the proceedings in the interior of a discharge tube set under high-voltage which Roentgen was dealing with. He observed the optical phenomenons in the interior of the tube. Accidentally—and this is the only accident in the whole matter—a fluorescent screen being covered with bariumtetracyanoplatinate, a relict of recent experiments, was still laying on the demonstration table. While the experiment was going on Roentgen was observing a fluorescence of the bariumtetra-cyanoplatinate. At first he assumed that it were caused by the UV-parts in the interior of the tube. The tube was covered with black paper, so that the UV-light could no more reach the fluorescent screen. Nevertheless, it beamed. At the time of Roentgen for this physical phenomenon no physical law was known. Therefore it must have been a new phenomenon, which had to be researched at once. This research was the outstanding performance of W. C. Roentgen. Everybody knows, which effect was entailed by the announcement of the discovery of the Roentgen-rays throughout the world. The best scientists of the world started working with the X-rays in order to find out further characteristics. It was 10 years later in 1905, that Charles G. Barkla in Liverpool succeeded in discovering the characteristic Roentgen-rays. 17 years later, in 1912, they succeeded in the diffraction of the X-rays and thus rendered the proof of the wave character by the physicists Max von Laue, Friedrich and Knipping. Before it W. C. Roentgen had researched the essential characteristics of his rays in more than 200 individual experiments and rendered by his thoroughness a research result, which is unique in the entire history of science worldwide up to the present days. His performance was rightly honoured with the first Nobel Prize which was ever awarded, the Nobel Prize for physics, in 1901.

Of course, while doing his research work W. C. Roentgen recognized at once the most important fields of application for his Roentgen-rays. With the first radiograph of a hand even the layman became aware of the possibilities in medical application. The application in the field of non-destructive material testing was proved by two other radiographs. With the X-ray of soldered zinc plates the possibility of welding control was given and with the X-ray of Roentgen's own sporting gun the application in technique could be guessed. Immediately after Roentgen's publication the X-rays could be applied in all fields worldwide. Roentgen deliberately refrained from financial advantages of his discovery. He could have applied for a patent for the generation of X-rays. But he thought, that everything he worked out as a state-employed university professor belonged to the general public. Among other things owing to this excellent personal trait of Roentgen, by the application of the X-rays only in medicine more human lives could be saved than were destroyed by all wars despite all disputes about radiation hazard.

The more it is astonishing if it becomes known, that the discovery and research of the X-rays was not the most important for physics, which Roentgen had achieved. As physicist he wrote 60 scientific works, and only the three works already mentioned above deal with the topic of the X-rays. The first proof of his scientific qualification he rendered already as a student in the age of 20 years. He wrote a chemistry revision course to a standard work which was hard to understand for students. In this very well schematized work Roentgen's ability to sort out facts clearly with the aim to exclude any mistakes can be recognized. His doctoral thesis, a theoretical treatise on problems in thermodynamics, are remarkable, too. Here Roentgen demonstrated courage. He acted against the existing school of thought while following an exact scientific way. He criticized an unobjective formulation of the then valid gas laws. At first the experts were unsure, but Roentgen was right.

The versatile Roentgen even developed an automatic selector in supplementation to the telephone constructed by Graham Bell. Roentgen succeeded in another work, too, it is the rotation of the plane of polarization of the light in gas. This was the phenomenon which had Faraday and other scientists already researched in vain. The importance of Roentgen was only recognized a long time later. This is concerned to an extension of the physical basis, which Graham Bell had worked out with the photoacoustic effect for solids, namely the photoacoustic effect in gases. This experiment of Roentgen is the basic principle of measurement of the photoacoustic spectroscopy. Today it is highly topical as standard analysis method, f.i. in the pollution control for the proof of air pollution, in blood tests and in researches on semiconductors.

The treatise of Roentgen on dielectric displacement current, submitted in 1888, is of high value with regard to the history of physics. With this test Roentgen succeeded in an experimental proof on Maxwell's theory in electricity. In the specialized literature this experiment was later called “Roentgen current”and was considered a model of ingenious experimental art and made Roentgen well-known worldwide to the physicists of his time long before the discovery of the X-rays.

This work of Roentgen shows an ingenious connection between theoretical models and the performance of proofs for the confirmation of the theory. This work was higher assessed scientifically by Roentgen himself than the discovery and research of X-rays. Roentgen founded the piezooptics by the research of pyro- and piezoelectric effects.

This short consideration of some works of Roentgen shows that Roentgen was familiar with all fields of physics and gives evidence of his high scientific qualification. It earned him many honours, f.i. honorary memberships in scientific societies throughout the world, medals, and last but not least the German Roentgen Museum, which was founded in his birthplace Lennep.

In communication with other people he was rather reserved, but to all, who were counted as his closest friends, he kept faith with. His long vacation trips throughout Europe, despite all then existing borders, were extraordinary at that time.

In the “Roentgen Year” we celebrate his 150th birthday and the 100th anniversary of the discovery of the X-rays. This discovery has opened great new paths in science, technique and medicine. But we should not only honour his person and his capability, but we should take his strength of character and his responsible dealing with physics as a shining example.

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