Lenard

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PHILIPP E. A. VON LENARD

On cathode rays

Nobel Lecture, May 28, 1906

A discovery by Hertz as early as 1887(8) completed shortly afterwards by Hallwachs (11), had shown that by mere exposure to ultraviolet light metal plates give off negative electricity to the air. This remarkable fact - nowadays usually referred to as the photo-electric effect - immediately captured my interest at that time and has also continued to do so since. Experiments carried out in collaboration with the astronomer Wolf showed me first of all that ultraviolet light roughens substances or pulverizes them (12; 46, p. 490). Subsequent experiments, however, caused me to think it unlikely that metal particles carried the negative charge off the plate. At the time I conducted my first experiments on cathode rays, when I had discovered that the air in front of the aluminium window becomes conductive (18) I formed the idea that cathode rays could be driven from the plate into the air by ultraviolet light. Both then and later I made repeated vain attempts to detect possible rays in the vacuum on fluorescent screens. Only my decision - based on Righi's work (14) - to use the electrometer instead of the fluorescent screen revealed the existence of the rays. The apparatus used is illustrated in Fig. 10. *U* is the plate to be irradiated and is in a complete vacuum; the quartz seal at *B* admits the ultraviolet light. The cathode rays start from *U* and a narrow beam is separated out by the hole in the counterplate *E*. This beam impinges on the small plate α which collects the negative charge brought by the beam and thereby indicates the existence of the radiation on the electrometer. We bring a magnet or the coil indicated by a broken line close to the tube in a suitable manner and then find the charge on the plate β instead of on α, indicating that the invisible ray is actually deflected by the magnet and in the appropriate direction for cathode rays. When carried out quantitatively, the experiment showed that the deflection is also of the correct degree, and that the same ratio obtains between charge and mass of the quanta as in the case of the rays generated in discharge tubes (32; 44, p. 150; 46).

Immediately it had been established beyond doubt in this way that cathode rays are produced by ultraviolet light and that their behaviour had become suffciently well known, I was soon able to detect them on fluorescent screens (44), then follow them further and use them. I shall refer to those aspects later. The following should be noted as regards the actual generation.

Firstly - an important point for pure experiments - it also occurs in a complete vacuum where the usual method fails. A gas need not be present but it does not interfere with the generation of the rays. What is involved is the direct action of the light on the metal of the plate. The initial velocities with which the quanta leave the plate are so slight that a negative charge of only a few volts on the counterplate is sufficient to compel the rays to reverse before reaching it. They then return to the irradiated plate in the same way as a stone thrown upwards falls black to the ground (32; 44).*

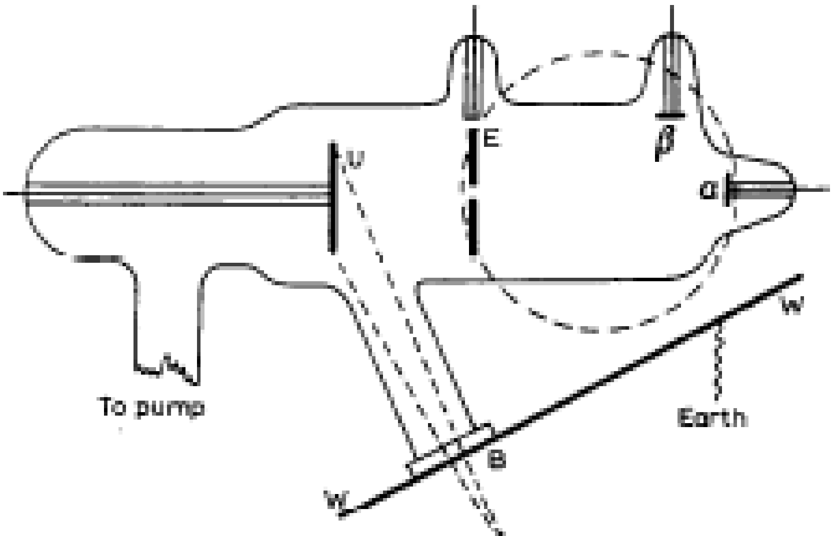

Fig. 10.

Philipp Lenard (eng)	
 Philipp Lenard in 1900	
Born	June 7, 1862 Pressburg, Kingdom of Hungary,Austrian Empire
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Alma mater	University of Heidelberg
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Known for	Cathode rays
Notable awards	Nobel Prize for Physics (1905)

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