

The Physics Experiments of Robert Wichard Pohl (1884–1976)

For decades, Robert Wichard Pohl taught his famous lectures of introductory physics in the old lecture hall of the Physics Institute at Goettingen University. These lectures became the foundation for three volumes entitled „Introduction into Physics“. Now, using Professor Pohl's original instruments in the same lecture hall in which he taught, this set of videos captures his extraordinary ingenuity and once more brings to life Pohl's great experimental skills.



Measurement of the electric field of the earth

Video title: Measurement of the electric field of the earth

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Series title: The Physics Experiments of Robert Wichard Pohl (1884-1976)

Abstract: The electric field of the earth will be determined. A parallel plate capacitor of area 1 m^2 is attached to the end of a long bamboo pole. The capacitor is connected to a ballistic galvanometer calibrated to measure current pulses (charges). On a balcony outside the lecture hall, the capacitor is held with its plates horizontal. When it is flipped 180° , the sign of the charges Q which are induced on the plates, reverses, and the galvanometer will measure $2Q$. From Q , the electric field in the air outside of the lecture hall can be determined, and the total charge of the earth estimated.

Source: Pohls Einführung in die Physik - Elektrizitätslehre und Optik. Lüders, Klaus; Pohl, Robert Otto (Hrsg.) 22. Aufl., 2006, Springer Berlin Heidelberg New York; p 36

Key words: Electric field, capacitor, ballistic galvanometer

Goal of the experiment: The determination of the electric field and charge of the earth.

Experimental setup: A parallel plate capacitor of area 1 m^2 is attached to the end of a long bamboo pole. The capacitor is connected to a ballistic galvanometer calibrated to measure current pulses (charges). On a balcony outside the lecture hall, the capacitor is held with its plates horizontal. When it is flipped 180° , the sign of the charges Q which are induced on the plates, reverses, and the galvanometer will measure $2Q$. From Q , the electric field in the air outside of the lecture hall can be determined.

Experiment: Two of the experimenters carry the capacitor to the balcony, while the third one turns on the ballistic galvanometer. When the capacitor is rotated by 180° , a charge $2Q = 5 \times 10^{-10} \text{ Ampsec}$ is measured. From this an electric field $E = 30 \text{ Volt/Meter}$ can be determined. Note that this value is not corrected for a distortion of the field in the vicinity of the building. From the direction of the current flow, it follows that the earth carries a negative charge. The average electric field of the earth is known to be somewhat larger, 130 Volt/Meter . From this value, the total charge of the earth is determined to be $6 \times 10^{15} \text{ Ampsec}$.

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