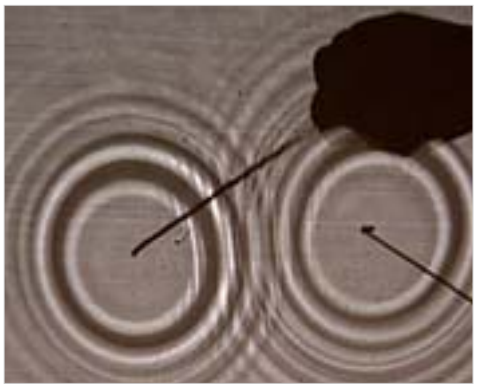
The Physics Experiments of Robert Wichard Pohl (1884–1976)

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.



Experiments with water waves

Video title: Experiments with water waves

Signature: C 14861

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

Abstract: Some of the fundamental properties of waves are demonstrated using surface waves in a water trough.

Source: Pohls Einführung in die Physik: Mechanik, Akustik und Wärmelehre, K. Lüders und R. O. Pohl (eds.), Springer-Verlag, 19th edn, 2004, § 113 – 122, Fig. 311 - 330

Key words: Acoustics, waves, water waves, interference, reflection, refraction, imaging, tunneling

Goal of the experiment: Demonstrating some of the fundamental properties of waves.

Experimental setup: In a flat trough with transparent bottom which is filled with water, circular and plane waves can be excited by dipping pins or plates into the surface, either manually, or periodically, using an eccenter. With a carbon arc and a mirror, the wave pattern can be made visible on the wall of the lecture hall. Various objects are placed in the path of the waves. In some instances, the depth of the water is reduced locally by placing pieces of plexiglass on the bottom of the trough, in order to reduce the wave velocity.

Experiment: The following experiments are being performed. (Note that in many instances it will be advisable to watch the individual pictures, rather than their rapid sequence, in order to observe details.)

1. A periodically dipped plate generates straight lines of excitations, as a model for plane waves.

2. A metal plate placed perpendicularly to the propagation direction reflects the incoming waves and creates a standing wave.

3. By turning the reflecting plate by 45°, the reflected wave travels in a horizontal direction.

4. Diffraction is demonstrated by inserting a metal plate part-way into the path of the plane wave. The wave penetrates by diffraction into the shadow region. 5. With two metal plates diffraction by a slit is demonstrated.

6. One and two pins are used to generate circular wave-trains. Note that the single pulses spread out into wavetrains, the shorter wavelengths travelling faster than the longer ones. Dispersion. 7. The same experiment is performed with pins driven periodically and in phase by an eccenter.

8. Refraction is demonstrated by placing a triangular plexiglass plate into the trough, therebydecreasing the water level. The plane wave generated in the deep water slows down as it enters the shallow water.

9. Refraction in shallow water is used to construct a converging lens for plane waves using a plexiglass plate with two convex surfaces.

10. Two triangular plexiglass plates are inserted into the trough such that they form a deep-water gap of variable width running diagonally through the picture. The wave is generated in the shallow water of the lower triangle (with a small wave velocity). As it reaches the gap (larger wave velocity) total internal reflection is observed. As the gap is narrowed, the wave can travel across it (frustrated total internal reflection).

Scientific Contributors:

Klaus Lüders	Department of Physics, Free University Berlin, Germany
Robert Otto Pohl	Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, USA
Gustav Beuermann	I. Physical Institute, University Goettingen, Germany
Konrad Samwer	I. Physical Institute, University Goettingen, Germany

Editor: Walter Stickan
Camera: Kuno Lechner
Sound: Thomas Gerstenberg
Video Editing: Abbas Yousefpour
Technical Assistant: Joachim Feist

Production and Distribution: IWF Wissen und Medien gGmbH, http://www.iwf.de,

IWF Wissen und Medien gGmbH
Nonnenstieg 72, D-37075 Goettingen
Phone: +49 (0) 551 5024 0
www.iwf.de

Leibniz Gemeinschaft

IWF
WISSEN UND MEDIEN
KNOWLEDGE AND MEDIA