# 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.

## The physics of swinging

**Video title:** The physics of swinging

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

**Abstract:** Using a torsional oscillator, it will be shown how its amplitude can be increased without external torques, merely by correctly timed variations of the moment of inertia, which requires work. This is the principle of setting a swing in motion, or of swinging on the high bar. The oscillator used is a rotating stool with a helical spring. The experimenter on the stool changes the moment of inertia by alternating his position from sitting to lying.

**Source:** Pohls Einführung in die Physik - Mechanik, Akustik und Wärmelehre. Lüders, Klaus; Pohl, Robert Otto (Hrsg.) 19. Aufl., 2005, Springer Berlin Heidelberg New York; p. 74

**Key words:** Mechanics, torsional oscillations, moment of inertia, conservation of angular momentum, parametric amplification, mechanical energy

**Goal of the experiment:** It will be shown how the amplitude of a torsional oscillator can be increased without external torques, merely by correctly timed variations of the moment of inertia, which does, however, require work. This is the principle of setting a swing in motion, or of swinging on the high bar.

**Experimental setup:** The torsional oscillator used is a rotating stool with a sturdy helical spring. The experimenter on the stool changes the moment of inertia by alternating his position from sitting to lying.

**Experiment:** The experimenter is lying, oscillating initially with some small amplitude he might have. As the oscillator moves through its equilibrium orientation (its angular velocity having reached its maximum), he quickly sits up. Because of the reduced moment of inertia, the law of the conservation of angular momentum requires that the angular velocity of the oscillator increases at this point. This, however, requires an increase of the kinetic energy of the oscillator, which is supplied by the work the experimenter does against the centrifugal forces as he decreases his moment of inertia. Because of this increase in mechanical energy, the oscillator will now swing to a larger angle. In subsequent half-cycles, this process is repeated, until the oscillator reaches an angle of ~ 180°.

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