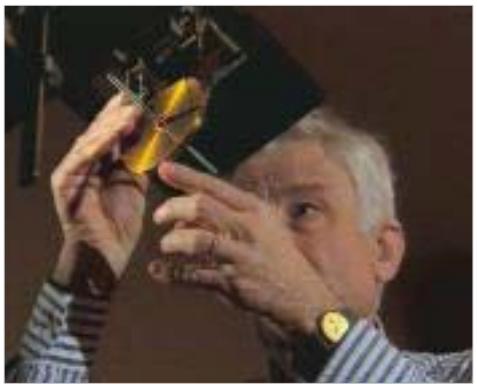
The Physics Experiments of Robert Wichard Pohl (1884–1976)

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.



Maxwell's disk

Video title: Maxwell's disk

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

Abstract: A body that is being accelerated downward weighs less than when at rest. This is demonstrated with a flywheel on a shaft suspended on one arm of a household scale (Maxwell's disk). When the flywheel is released, it accelerates downward, and the scale reads a reduced weight. During the subsequent rise (the flywheel still accelerating downward!) the scale again indicates a reduced weight.

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. 29

Key words: Mechanics, accelerated motion, rotation, Newton's second law, Maxwell's disk

Goal of the experiment: A body that is being accelerated downward weighs less than when at rest. This is demonstrated with a flywheel on a shaft suspended on one arm of a household scale (Maxwell's disk). This arrangement offers two advantages: The downward acceleration is reduced, relative to a free fall, and the upward force exerted on the disk, which is equal and opposite to its weight, can be easily measured.

Experimental setup: The flywheel is suspended on one arm of the scale with two strings which wrap around the thin shaft. The entire arrangement is shown clearly in shadow projection.

Experiment: The experiment is done in two steps:

1. With the flywheel at rest, the scale is balanced (note the damped oscillations of the scale). When the flywheel is released, it accelerates downward, and the scale reads a reduced weight, somewhat obscured by oscillations. At its lowest point, the flywheel reverses its velocity. At that instant, an upward acceleration occurs, and the scale is held fixed in the balanced position (fingers). During the subsequent rise (the flywheel still accelerating downward!) the scale again indicates a reduced weight.

2. The experiment is repeated so as to avoid the oscillations: For this, the reduction of the weight measured in the first part is compensated with a small weight on the right arm of the scale. When the flywheel is now released, with the scale initially held in equilibrium, it remains in equilibrium even after the fingers have been removed. After again catching the impulse at the lowest point of the flywheel, the scale remains balanced while the flywheel first rises, and then drops again. This rise and fall, unobscured by oscillations, is the clearest demonstration of the fact that a downward acceleration leads to a reduction of the weight, regardless of the direction of the velocity vector.

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