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.

Rotation around free axes

Video title: Rotation around free axes

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

Abstract: It will be shown that the axis of maximum moment of inertia is also the most stable axis of free rotation. For this, objects of different shapes are suspended on thin wires from the vertical axis of an electric motor, and are rotated at increasing frequencies. They are a cylindrical metal rod, a piece of wood in the form of an egg, and a loose loop of a metal chain.

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. 75

Key words: Mechanics, rotational motion, free axis, moment of inertia

Goal of the experiment: It will be shown that the axis of maximum moment of inertia is also the most stable axis of free rotation.

Experimental setup: Objects of different shapes are suspended on thin wires from the vertical axis of an electric motor, and are rotated at increasing frequencies. They are a cylindrical metal rod, a piece of wood in the form of an egg, and a loose loop of a metal chain.

Experiment: Although the axis of the rod, being the axis of the smallest moment of inertia, should be an axis of free rotation, it is only so at low frequencies, when gravity helps its stabilization. At high frequencies, however, the rod switches to a rotation around a perpendicular axis, which is the one of maximum moment of inertia. The same behavior is observed for the egg-shaped object. The chain, finally, during rotation takes the form in which its moment of inertia is maximized, which is a circle. This circle then rotates stably around its axis, this being the axis of maximum moment of inertia of a circular ring.

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

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