

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.



Torsional pendulum on a rotating table

Video title: Torsional pendulum on a rotating table

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

Abstract: A torsional pendulum on a rotating table is an instructive example of inertial forces in accelerated reference frames. It is shown that through the proper choice of the position of the pendulum it becomes insensitive to any angular acceleration of the table, i.e. the inertial forces (torques) vanish. The pendulum consists of a metal bar of length $l = 52$ cm mounted the distance $s = 5$ cm away from its center of mass on a vertical axis held by a helical spring. It is mounted on a rotating table, also with a vertical axis.

Source: Pohl's Einführung in die Physik - Mechanik, Akustik und Wärmelehre. Lüders, Klaus; Pohl, Robert Otto (Hrsg.) 19. Aufl., 2005, Springer Berlin Heidelberg NewYork; p. 98

Key words: Mechanics, accelerated reference frames, torsional pendulum, rotational inertia, Steiner's theorem

Goal of the experiment: A torsional pendulum on a rotating table is an instructive example of inertial forces in accelerated reference frames. It is shown that through the proper choice of the position of the pendulum it becomes insensitive to any angular acceleration of the table, i.e. the inertial forces (here torques) vanish.

Experimental setup: A torsional pendulum consists of a metal bar of length $l = 52$ cm mounted the distance $s = 5$ cm away from its center of mass on a vertical axis held by a helical spring. This pendulum is mounted on a rotating table which also has a vertical axis. Angular accelerations of the table are produced manually. Resulting motions of the pendulum can be observed both directly and with shadow projection.

Experiment: Initially, the pendulum is positioned $R \sim 30$ cm away from the axis of the table. An angular acceleration of the table leads to oscillations of the pendulum. The experiment is repeated for $R \sim 80$ cm, again leading to oscillations. Finally, the distance is chosen as $R = 50$ cm. In this case, the pendulum remains motionless in the frame of the rotating table, regardless of the angular acceleration. A calculation shows that this occurs when $l^2 = 12 s(R - s)$.

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