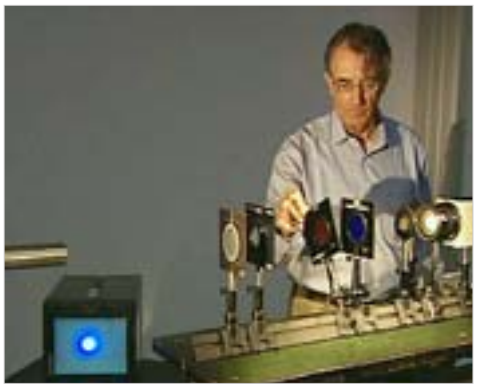
The Physics Experiments of Robert Wichard Pohl (1884–1976)

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.



Resolving power

Video title: Resolving power

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

Abstract: It is shown that in an optical image the individual light spots are diffraction patterns caused by the opening of the imaging lens. The resulting limit of the angular resolution is demonstrated with the aid of two pairs of holes with different separations.

Source: Pohls Einführung in die Physik - Elektrizitätslehre und Optik. Lüders, Klaus; Pohl, Robert Otto (Hrsg.) 22. Aufl., 2006, Springer Berlin Heidelberg New York; p. 229, 293

Key words: Optics, diffraction by circular apertures, resolving power

Goal of the experiment: It will be shown that in an optical image the individual light spots are diffraction patterns caused by the opening of the imaging lens. The resulting limit of the angular resolution is demonstrated with the aid of two pairs of holes with different separations.

Experimental setup: An illuminated spherical opening of 0.1 mm diameter, or pairs of such openings, are imaged by a lens of several cm diameter onto a video camera, and can be viewed on a monitor. A screen with 2000 randomly distributed holes of 0.2 mm diameter , placed before the lens, is used to reduce the effective diameter of the lens to 0.2 mm. The large number of the holes serves to maintain sufficient brightness.

Experiment: 1) Without the screen, the single opening is imaged by the lens. On the monitor, a well-focussed circle is seen. (The two color filters in the light path are used here only to reduce the brightness). Now the effective diameter of the lens is reduced by placing the screen in front of the lens. The image of the opening, which had previously been sharp, now has the shape of a large diffraction disk. Its diameter is clearly noticed to be larger for red than for blue light.

2) The reduced resolving power resulting from the large size of the diffraction disks is demonstrated by imaging pairs of openings with different separations. Using the more widely spaced pair (spaced 1.0 mm apart) both openings can be identified clearly even for red light, i.e. they can be resolved. For the more closely spaced pair (spaced only 0.3 mm apart), however, the two red diffraction disks overlap to the point of being barely resolved.

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