Diffraction at a slit and Heisenberg's uncertainty principle 2.3.01-00

What you can learn about ...

- ➔ Diffraction
- ➔ Diffraction uncertainty
- ➔ Kirchhoff's diffraction formula
- ➔ Measurement accuracy
- ➔ Uncertainty of location
- ➔ Uncertainty of momentum
- ➔ Wave-particle dualism
- ➔ De Broglie relationship

Principle:

The distribution of intensity in the Fraunhofer diffraction pattern of a slit is measured. The results are evaluated both from the wave pattern viewpoint, by comparison with Kirchhoff's diffraction formula, and from the quantum mechanics standpoint to confirm Heisenberg's uncertainty principle.

What you need:

Laser, He-Ne 1.0 mW, 230 VAC	08181.93	1
Diaphragm with 3 single slits	08522.00	1
Diaphragm with 4 double slits	08523.00	1
Diaphragm with 4 multiple slits	08526.00	1
Diaphragm holder for optical base plate	08040.00	1
Photoelement for optical base plate	08734.00	1
Sliding device, horizontal	08713.00	1
Digital multimeter 2010	07128.00	1
Universal measuring amplifier	13626.93	1
Optical profile bench, l = 1500 mm	08281.00	1
Base for optical profile bench, adjustable	08284.00	2
Slide mount for optical profil bench, h = 30 mm	08286.01	3
Connecting cable, 4 mm plug, 32 A, red, l = 50 cm	07361.01	1
Connecting cable, 4 mm plug, 32 A, blue, l = 50 cm	07361.04	1

Complete Equipment Set, Manual on CD-ROM included

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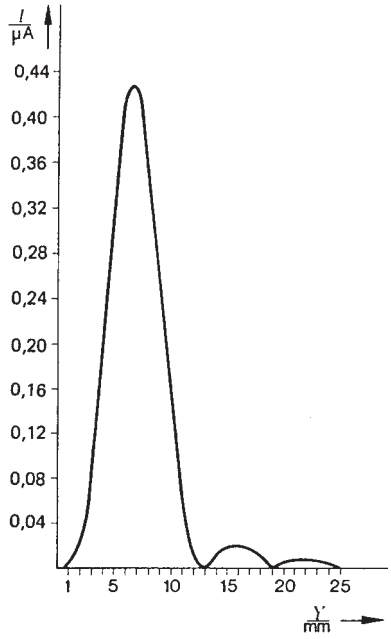

Intensity in the diffraction pattern of a 0.1 mm wide slit at a distance of 1140 mm. The photocurrent is plotted as a function of the position.

Tasks:

1. To measure the intensity distribution of the Fraunhofer diffraction pattern of a single slit (e.g. 0.1 mm).
   The heights of the maxima and the positions of the maxima and minima are calculated according to Kirchhoff's diffraction formula and compared with the measured values.
2. To calculate the uncertainty of momentum from the diffraction patterns of single slits of differing widths and to confirm Heisenberg's uncertainty principle.