User instructions Optical grating model

15.12.10 Ae 3244.00

Description:
It can be difficult to visualize the operation of an optical grating, so the explanation is most often based upon drawings. This apparatus is an optical grating with a very large grating spacing - large enough for the “lines” to be easily seen with the naked eye. In this manner students can directly observe the structure of the grating and see the result of sending monochromatic light through the grating.

It is of interest to note that the very first optical gratings were produced in 1820 by Joseph von Fraunhofer (1787-1826), an optical worker in Munich. He stretched fine wires between two parallel threaded rods, and he was able to resolve the sodium D-lines (a pair of spectra lines close together around 589 nanometers).

The set supplied here consists of parts for making 4 models plus one roll of 0.30 mm nylon thread.

Required accessories:
A laser: 2885.00/2885.10/2885.20
Support stand: 0004.00

Assembly instructions:
The optical grating model is assembled as indicated in the illustration. The nylon thread is then wound around the posts to form the grating. It is important that the nylon string is stretched tightly as it is wound.

Suggestions for use:
Laser light e.g. from a helium-neon laser is sent perpendicular to the plane of the grating. The diffraction pattern can be observed on a screen or wall at least 6 meters away. The greater the distance between the grating and the viewing surface, the larger and more visible the diffraction pattern becom-

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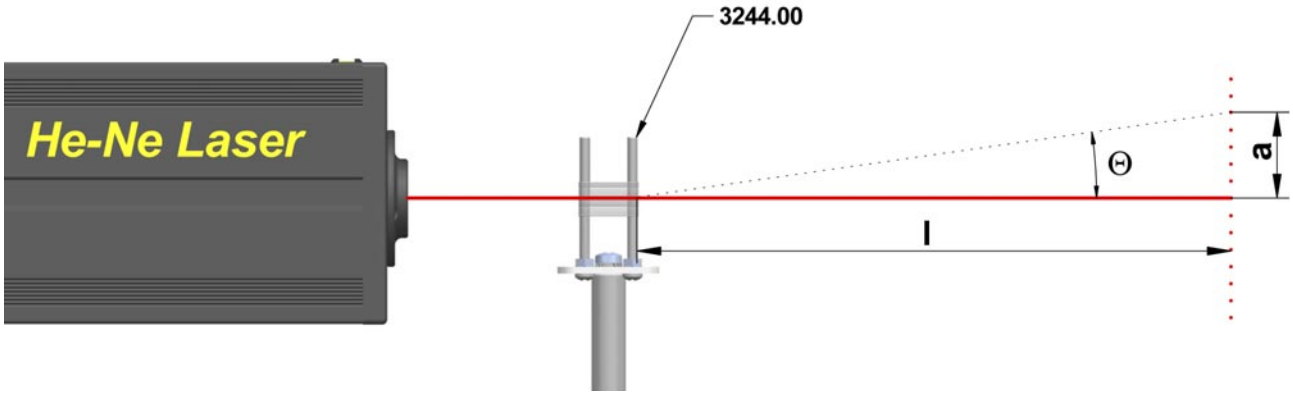

es. Knowledge of the distance from the grating to the screen, the distance between the threads in the grating and simple geometry allows the grating equation to be confirmed.

Use a caliper to determine the grating spacing, e.g. by measuring the distance between 10 threads and dividing by 10.

Calculations and geometry:

The grating equation is as follows:

$$\sin \Theta = (n \cdot \lambda)/d$$

where d is the grating spacing, Θ is the deviation angle, n is the order of the diffraction maximum with respect to the center of the pattern, and λ is the wavelength of the light from the laser.

To determine the position of the 0'th order maximum, make a mark on the screen where the laser beam strikes without a grating in the beam.

The angle Θ can be found from the equation $\tan \Theta = a/l$, where the distances a and l can be seen in the figure.

For small angles Θ, $\tan \Theta = \sin \Theta$, so the grating equation can be rewritten in simpler form for younger pupils:

$$a/l = (n \cdot \lambda)/d.$$

Technical data:

The pitch of the machine screw (which corresponds to the grating spacing) is 0.5 mm.

Spare parts:

Nylon line: 97180240 (Any round nylon line can be used, but it must not be thicker than the screw pitch. The color is not important.)