Modern Optics: Homework 24

Due: 20 November 2015

1 Double slit diffraction experiment

Carry out the diffraction experiment as suggested, recording the best fit parameters A, B, C, D for the fit

$$I = A\left[\frac{\sin\left(B(x-x_0)\right)}{B(x-x_0)}\right]^2\left[\frac{\sin\left(2C(x-x_0)\right)}{2\sin\left(C(x-x_0)\right)}\right]^2 + D.$$

a) Use B to determine the wavelength of the light emitted by the laser (including an error estimate).

b) Use C to determine the wavelength of the light emitted by the laser (including an error estimate).

c) How do these compare to the wavelength as determined using the diffraction grating?

2 Multiple slit diffraction

Consider various multiple slit arrangements, for which $b = 2\lambda$ and $d = 20\lambda$.

a) Plot the intensity patterns for 3 slits and 10 slits over the range $-0.50 \leqslant \theta \leqslant 0.50$ on the same set of axes.

b) How many subsidiary maxima appear between each principle maximum for the two cases?

c) As the number of slits increases what happens to the width of the principle maxima?

d) As the number of slits increases what happens to the intensity between the principle maxima?

3 Bennett, *Principles of Physical Optics*, 6.13, page 307.

4 Bennett, *Principles of Physical Optics*, 6.16, page 308.

5 Bennett, *Principles of Physical Optics*, 6.38, page 343.