Grating Spectrometer

Rahmanyaz Annyyev, Hikmat Gulaliyev

27 April 2024

Abstract

1 Introduction

One of the most common in optical spectroscopy is the grating spectrometer. The grating spectrometer is an instrument comprised of reflecting or transmitting elements separated by a distance comparable to the wavelength of light under consideration. Some examples of gratings include a pattern of transparent slits (or apertures) in an opaque screen or a collection of grooves on a substrate. The main purpose of the grating spectrometer is to disperse light into its constituent wavelengths. Upon incidence, the light is diffracted in multiple directions. The angle of diffraction depends on the wavelength of the light and the spacing of the grating. After diffraction, the light waves interfere with each other, producing a pattern of bright and dark spots. The bright spots correspond to constructive interference, while the dark spots correspond to destructive interference.

To find the percentage error between the calculated and literature values of the wavelengths, we use the formula

$$\text{Percentage error} = \left| \frac{\lambda_c - \lambda_l}{\lambda_l} \right| \times 100\% \tag{1}$$

where λ_c is the calculated wavelength and λ_l is the literature value of the wavelength.

2 Data & Results

3 Extra credit

Gas discharge lamp = Mercury			Grating spacing (d) = 600 lines/mm			
Color	θ° (Clock. rot.)	θ° (Coun.-clock. rot.)	θ° (Average)	λ nm (Calc.)	λ nm (Lit.)	% error
Violet	$14^\circ 23'$	$14^\circ 30'$	$14^\circ 26'$	415.4	404.6	2.676
Violet	14°	$14^\circ 50'$	$14^\circ 25'$	415.0	407.8	1.765
Blue	15°	$15^\circ 30'$	$15^\circ 15'$	438.4	435.8	0.595
Blue-green	$17^\circ 2'$	$17^\circ 35'$	$17^\circ 18'$	495.6	491.6	0.814
Green	$18^\circ 20'$	$18^\circ 40'$	$18^\circ 30'$	528.8	546.1	3.169
Orange	$20^\circ{}'$	$21^\circ 39'$	$20^\circ 49'$	592.3	577.0	2.649
Orange	$20^\circ 10'$	$21^\circ 58'$	$21^\circ 4'$	599.1	579.1	3.454

Table 1: Results of the grating spectrometer experiment.