UCD School Of Physics

PHYC30170 Physics with Astronomy and Space Science Lab 1; CCDs and Spectroscopy

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Abstract

The aim of this experiment was to calibrate a CCD for spectroscopy and determine the resolution of a spectrograph. This was done by comparing the emission spectrum of a mercury arc lap to reference values... INSERT RESULTS.

1 Introduction

2 Theory

A diffraction grating is used to split incident light into its separate wavelengths. As a diffraction grating is an array of very narrow and evenly spaced slits, the diffraction pattern from each slit interferes such that the light disperses by a angle θ as described by equation 1[1].

$$n\lambda = dsin\theta \tag{1}$$

where d is the spacing between the slits, λ is the wavelength of the incident light, θ is the angle which the light is diffracted by and n is a positive integer. This process is the primary element of a spectrograph.

A spectrograph is an instrument used to measure incoming light and record its spectrum[2]. It splits the incoming light based on its wavelength through diffraction. There are five key components to a spectrograph: telescope, slit, collimator, diffraction grating and detector, as shown in figure 1. The telescope focuses the incident light on the slit which only allows a small (ideally 1D) slice of the target through[3]. The light diverges after the slit and so a collimator is used to make the rays parallel again to ensure that all parts of the light hit the grating at the same angle of incidence.

Diffraction grating and equation + figure, what is the spectrograph setup, arc lamps

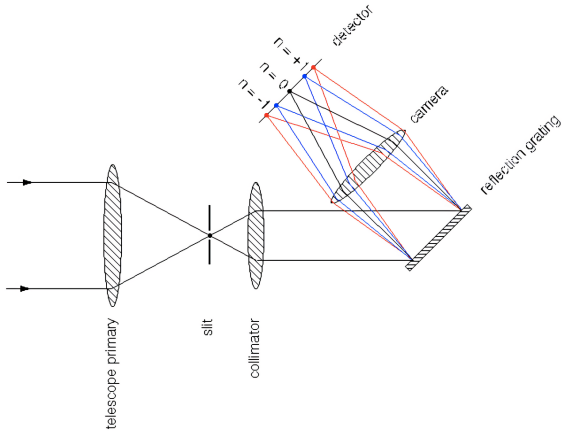

Figure 1: Diagram of a sample spectrograph setup. The primary lens focuses the incident light through a slit. The collimator makes the rays parallel as they diffract off of the reflection grating. A last lens focuses the rays on the detector.

+ emission lines

3 Methodology

3.1 Apparatus

Photo of experimental setup + focal lengths of all pieces, Atik 314L+ CCD

References

[1] Hugh D. Young et al. *Sears and Zemansky's university physics: with modern physics*. Pearson Education Limited, 2020.

[2] *Obtaining Astronomical Spectra - Spectrographs*. URL: `https://www.atnf.csiro.au/outreach/education/senior/astrophysics/spectrographs.html` (visited on 10/23/2022).

[3] Morgan Fraser. "CCDs and Spectroscopy". In: (Aug. 24, 2022).