Determining the wavelength of H-α emission

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September 3, 2021

PHY259 Lab Report
Registration Number: 11912610 Section: G2903

Measurements & Calculations

A mercury lamp was used as the light source. The number of grating lines N per unit length is taken to be 600 mm^{-1}. The true wavelength of H-α known to us is 656.281 nm.

The angular measurements were the following.

Position	V1		V2		Difference
	Main Scale	Vernier Scale	Main Scale	Circular Scale	
Left	336	18	156	18	180
Right	23	14	203	14	180

Table 1: Position of H-α for the left and right first orders of diffraction. The main scale readings are in degrees, and each vernier scale division is equivalent to 2'.

The difference between the left and the right is of $2\theta = 46^o52'$. This gives the angular position of H-α in the first order from the center to be $\theta = 23^o26'$.

The grating equation is

$$d\sin\theta = m\lambda$$

Since $d = 1/N$ where N is line density, in SI units $N = 6 \times 10^5$ per metres gives $d = 1.67 \times 10^{-6}$ For first order, $m = 1$

$$(1.67 \times 10^{-6}) \times \sin\left(23^o26'\right) = \lambda$$
$$\implies \lambda = 6628.02\text{Å}$$

Results

The measured wavelength of H-α is 6628.02Å, which is 45.21Åoff the true value of 6562.81Å, giving a percentage deviation of 0.69%