南京邮电大学
Nanjing University of Post & Telecom

物理实验教学中心

Physics Expeiment Center

QUALITATIVE STUDY OF ATOMIC SPECTRA

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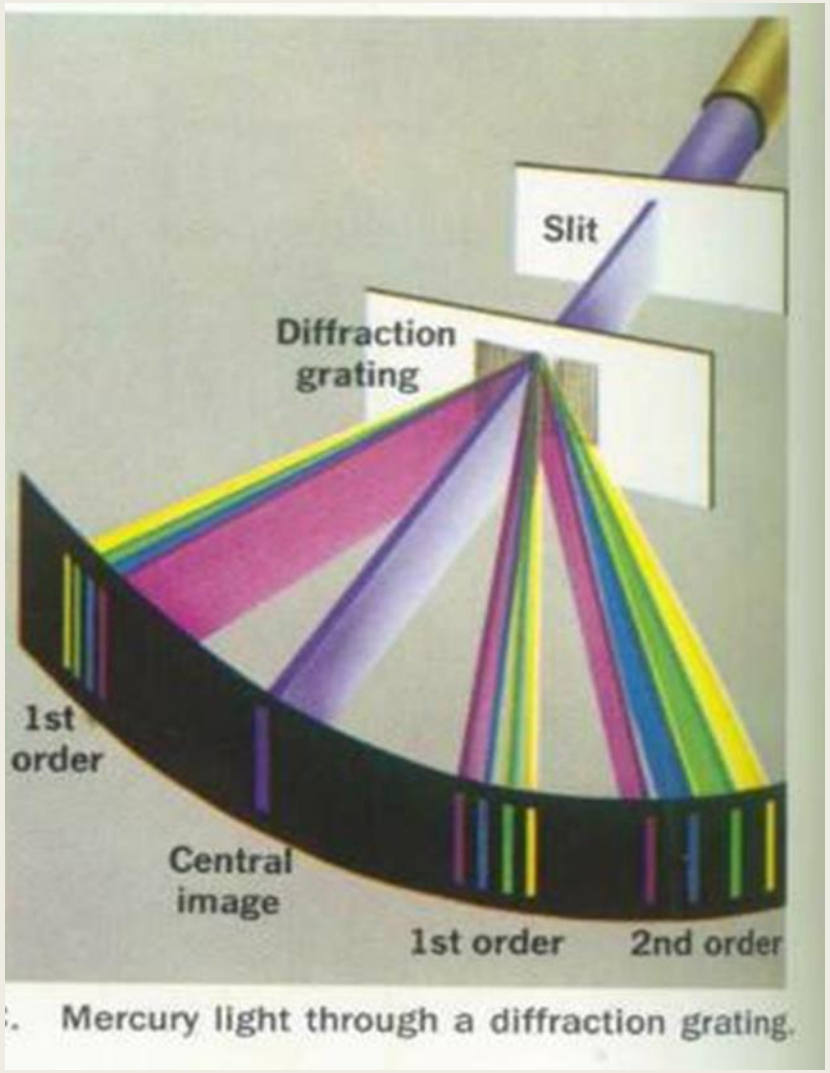
NJUPT

I. Diffraction grating



. Mercury light through a diffraction grating.

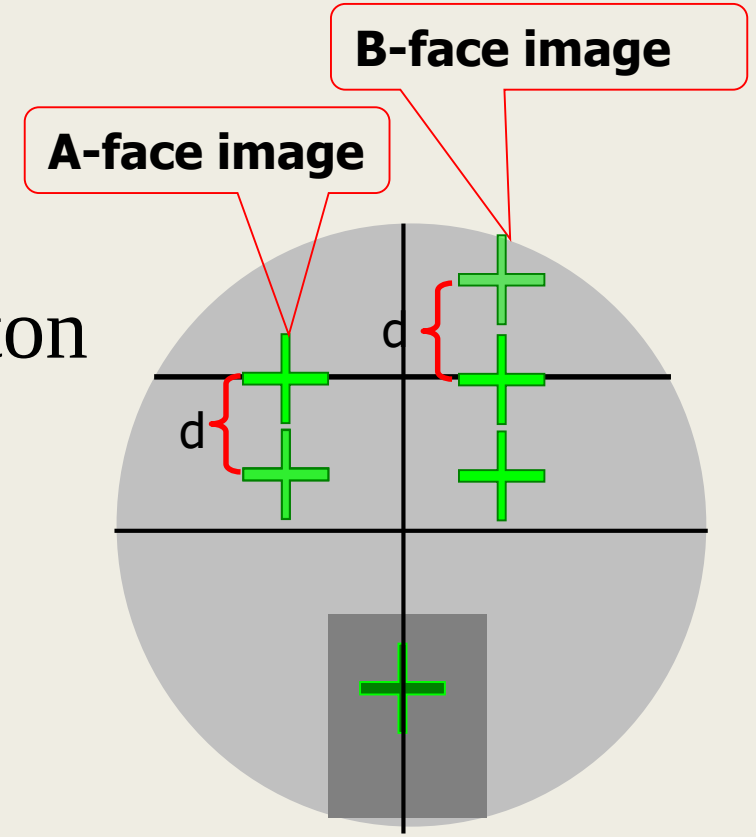
Grating equation:

$$d*\sin\theta = k*\lambda,\ k=0,\pm1,\ \pm2\ldots.$$

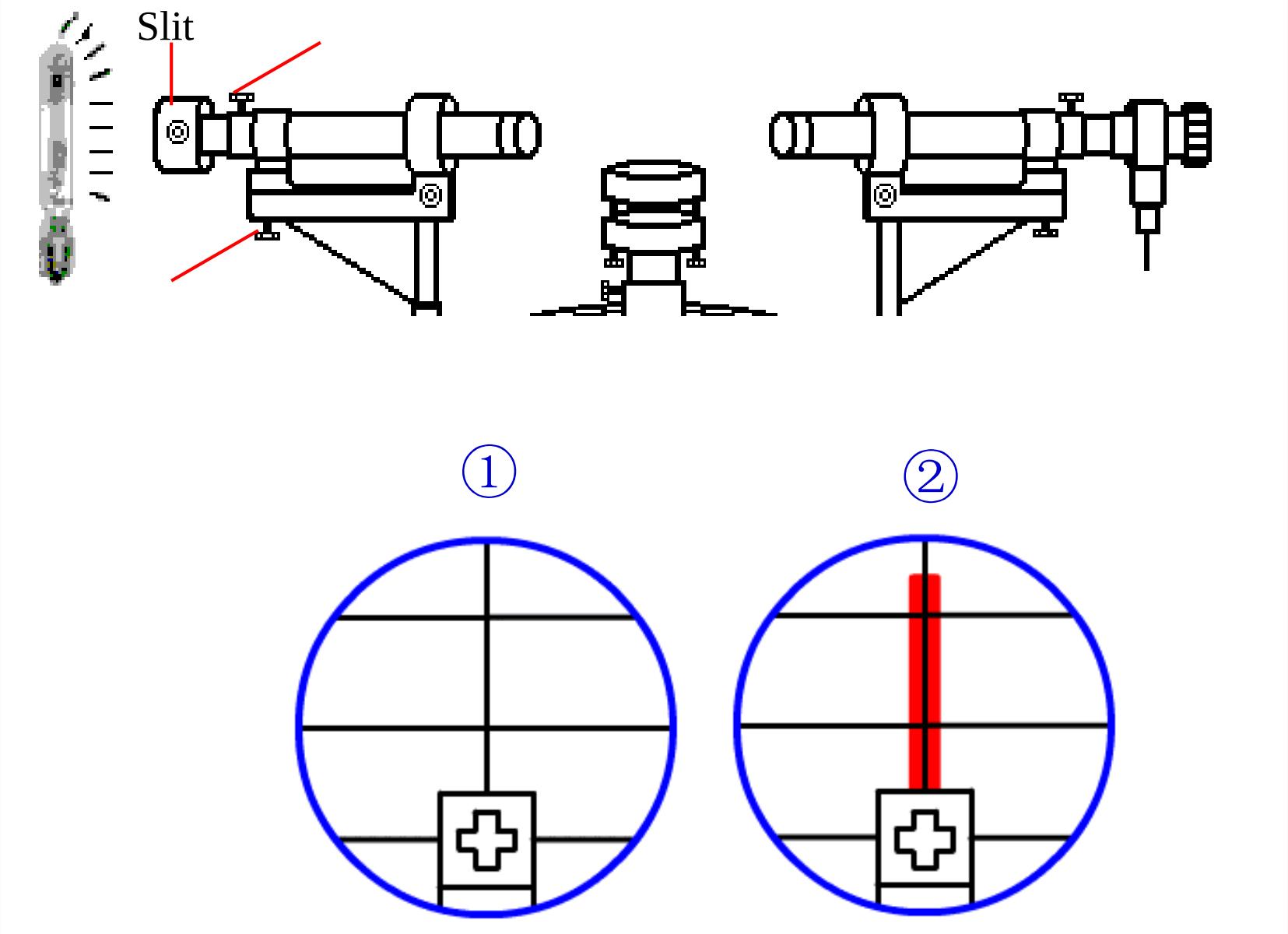
d: grating constant
θ: diffraction angle
k: order
λ: wavelength

II. The adjustment of spectrometer

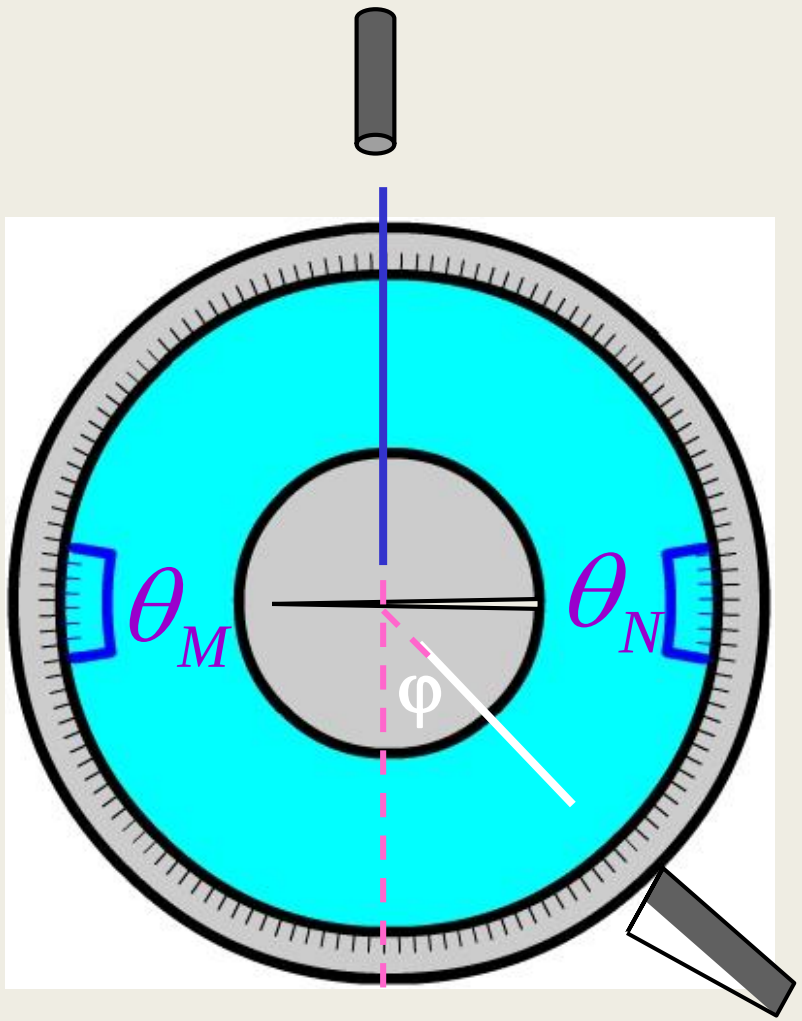
- Final vision：see right
- **Method：**
  - Three adjusting screw button under the loading platform
  - The telescope elevation adjusting screw
- Steps：
  - Coarse adjustment
  - Fine ajustment



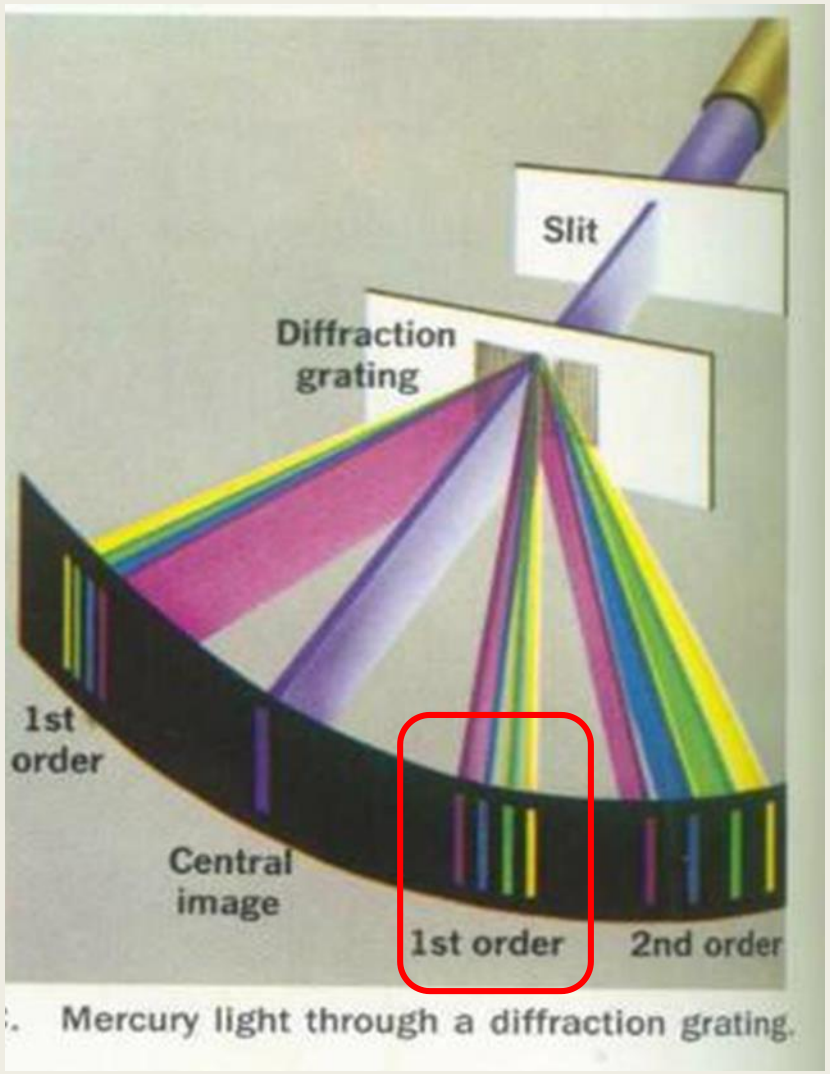
collimator



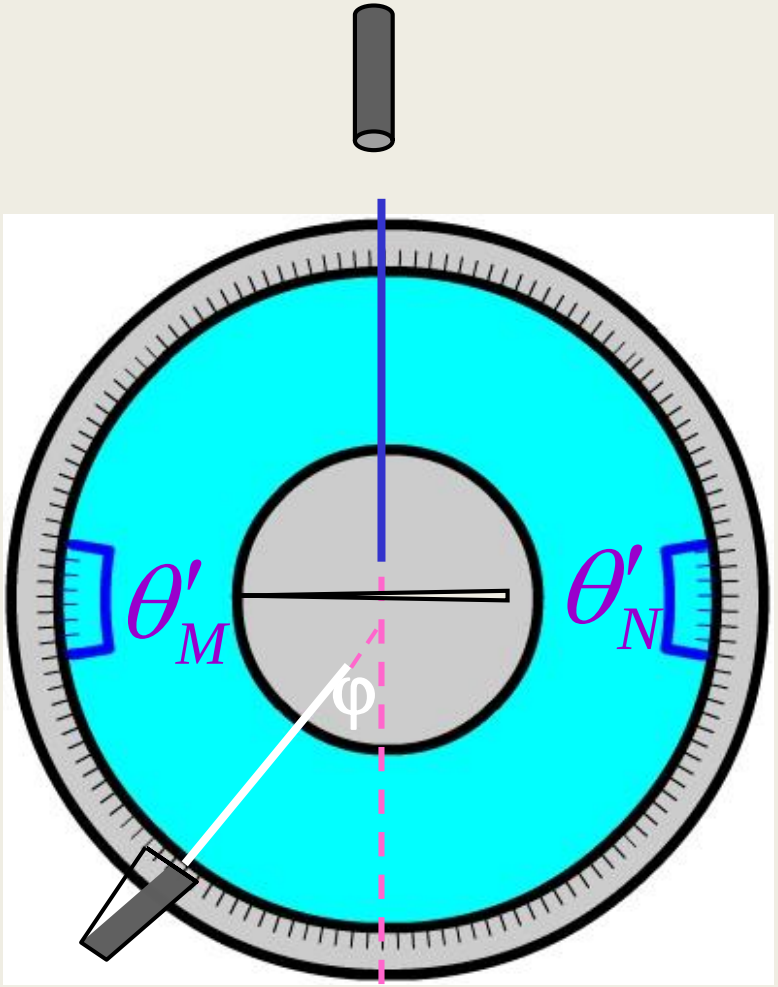
Measurement of the first-order diffraction angles



Right side

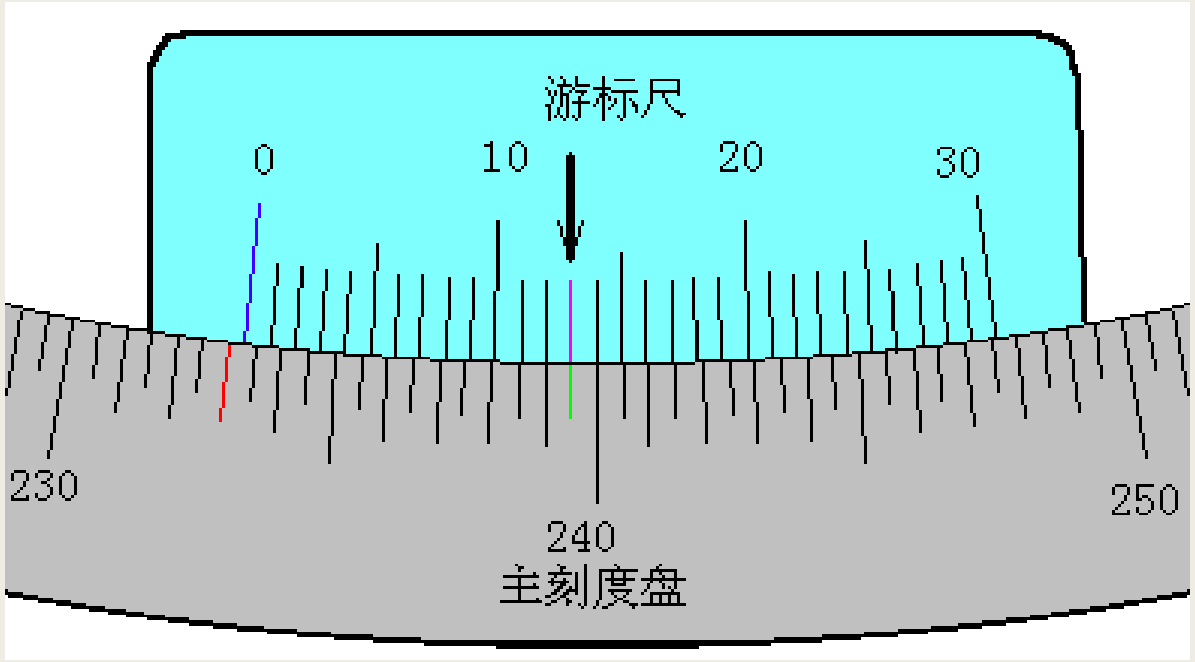


Mercury light through a diffraction grating.



Left side

Read the angle



233°13′

III. Experiment contents

1. With grating as diffraction device, measure the first-order diffraction angle of helium, determine the diffraction angle(φ)-wavelength(λ) relation graph according to the known helium spectral wavelength:

Color	Wavelength (nm)	Color	Wavelength (nm)	Color	Wavelength (nm)
Red(dark)	706.52	Green(light)	504.77	Blue	471.31
Red	667.82	Green	501.57	Purple	447.15
Yellow	587.56	Cyan	492.19	Purple (dark)	438.79

at least 6 groups of data(uncovered rows), plot λ-φ relation graph

Color	$\lambda\,(nm)$	θ_M	θ_N	θ'_M	θ'_N	$\varphi = \frac{1}{4}(\lvert\theta'_M - \theta_M\rvert + \lvert\theta'_N - \theta_N\rvert)$
Red(dark)	706.52					
Red	667.82					
Yellow	587.56					
Green(light)	504.77					
Green	501.57					
Cyan	492.19					
Blue	471.31					
Purple	447.15					
Purple (dark)	438.79					

2. Measure the diffraction angle of mercury lamp, find out the corresponding wavelength(λ) of mercury according to the former λ-φ relation graph from the helium data.

Color	θ_M	θ_N	θ'_M	θ'_N	$\varphi = \frac{1}{4}(\lvert\theta'_M - \theta_M\rvert + \lvert\theta'_N - \theta_N\rvert)$	$\lambda(nm)$
Orange						
Yellow						
Green						
Blue						
Purple						

V. Original data

1. Helium lamp (six groups of data (uncovered)):

Color	$\lambda(nm)$	θ_M	θ_N	θ'_M	θ'_N	$\varphi = \frac{1}{4}(\lvert\theta'_M - \theta_M\rvert + \lvert\theta'_N - \theta_N\rvert)$
Red(dark)	706.52					
Red	667.82					
Yellow	587.56					
Green(light)	504.77					
Green	501.57					
Cyan	492.19					
Blue	471.31					
Purple	447.15					
Purple (dark)	438.79					

2. Mercury lamp (four groups of data):

Color	θ_M	θ_N	θ'_M	θ'_N	$\varphi = \frac{1}{4}(\lvert\theta'_M - \theta_M\rvert + \lvert\theta'_N - \theta_N\rvert)$	$\lambda(nm)$
Orange						
Yellow						
Green						
Blue						
Purple						

END