

氢氦光谱和类氢光谱

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光谱理论

氢在可见光波段能量，巴尔末线系：

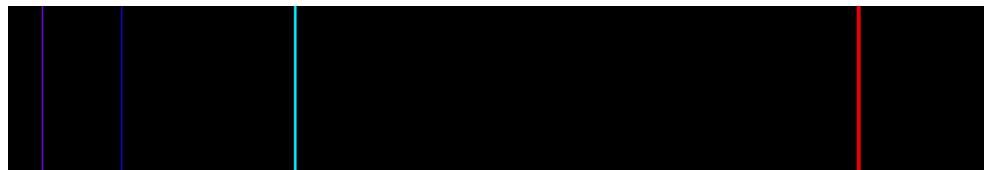
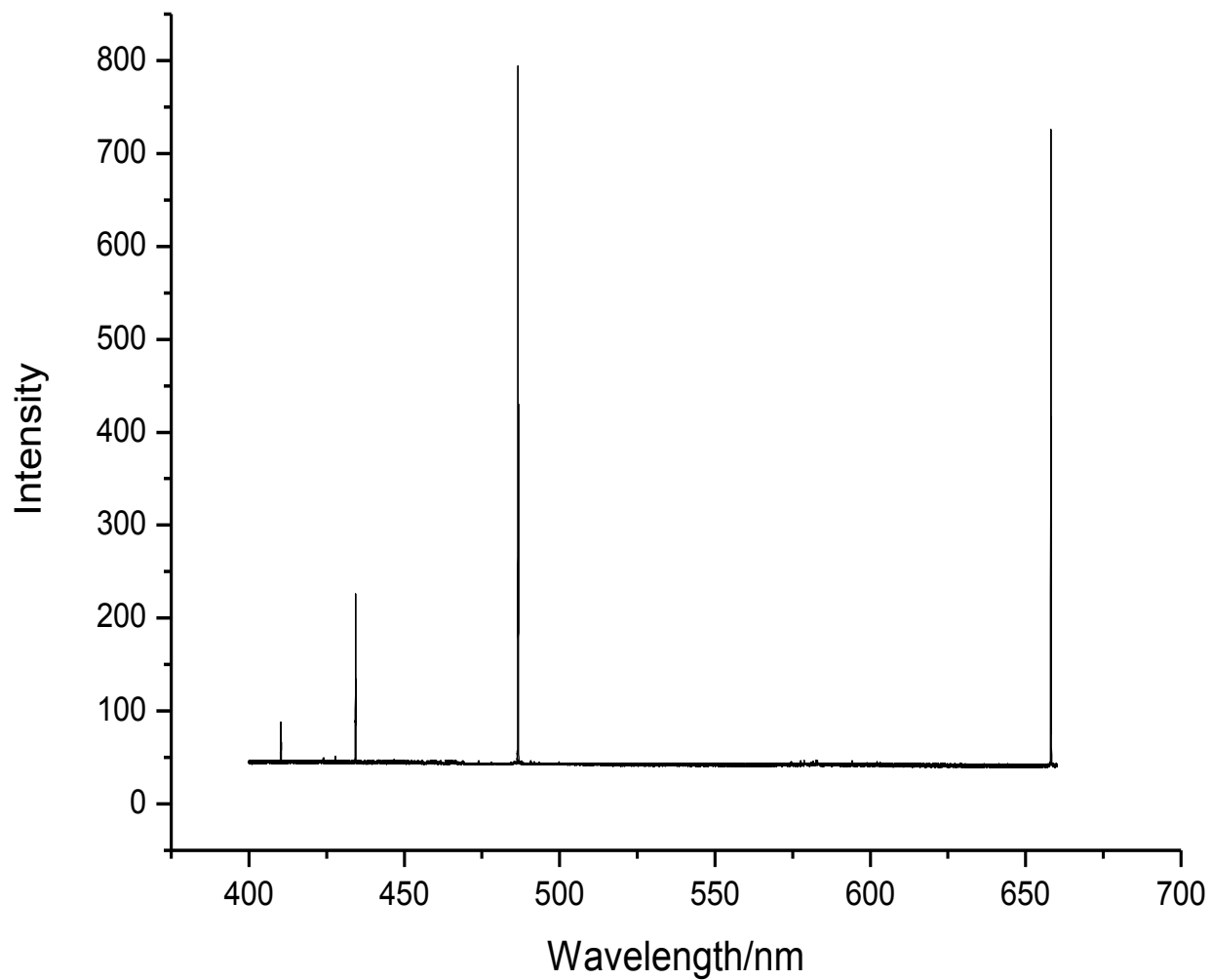
$$\nu = \frac{1}{\lambda} = R \left(\frac{1}{2^2} - \frac{1}{n^2} \right)$$

$$R = R_{\infty} \frac{1}{1 + m_e / m_{\text{核}}}$$

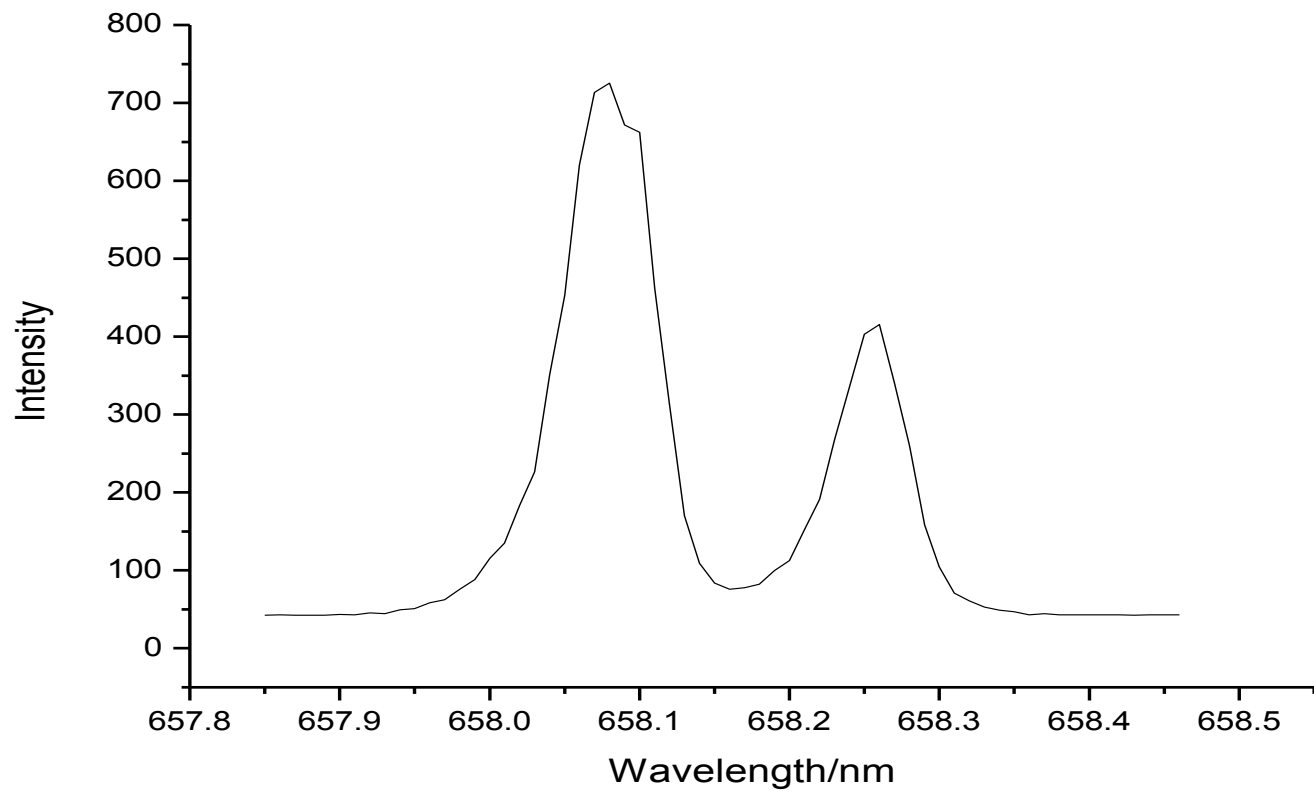
实验仪器



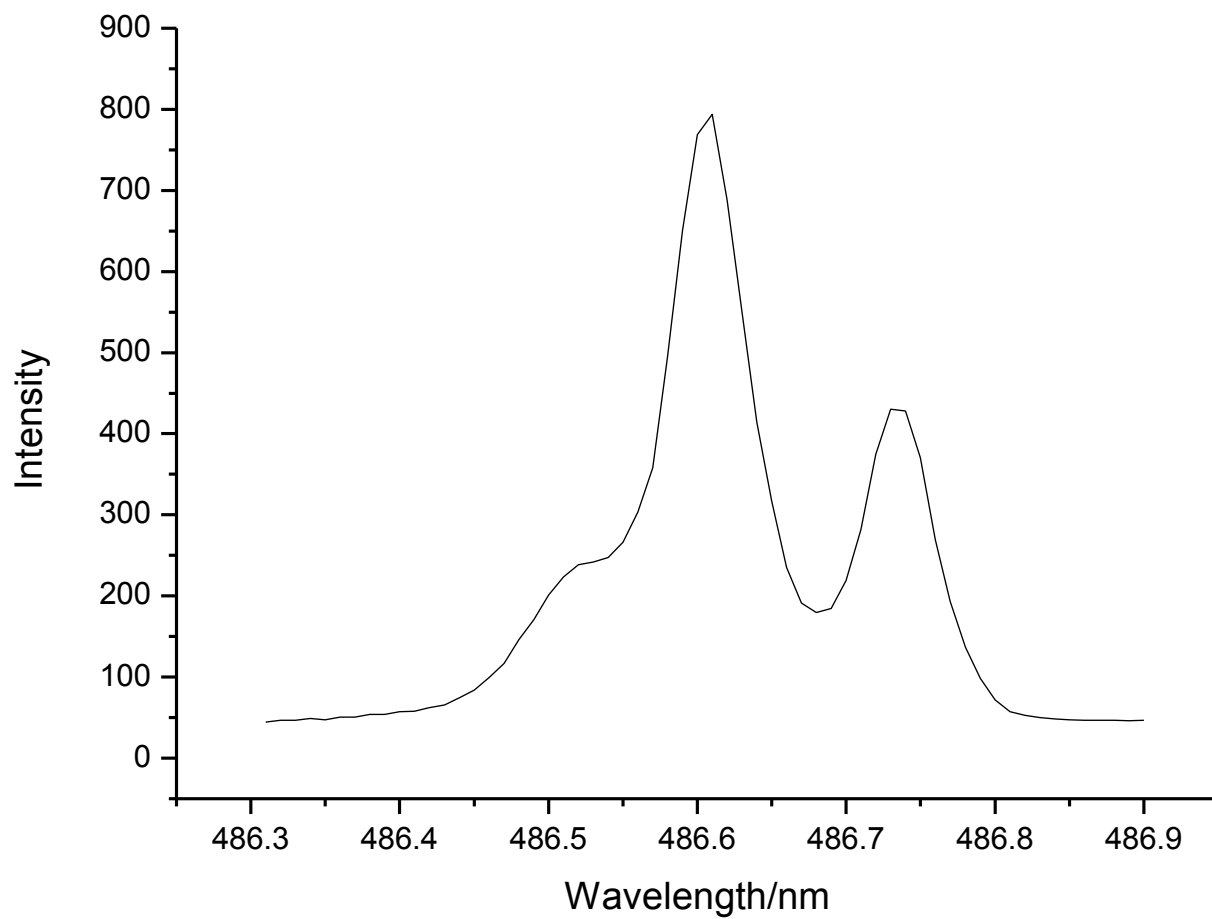
巴尔末线系



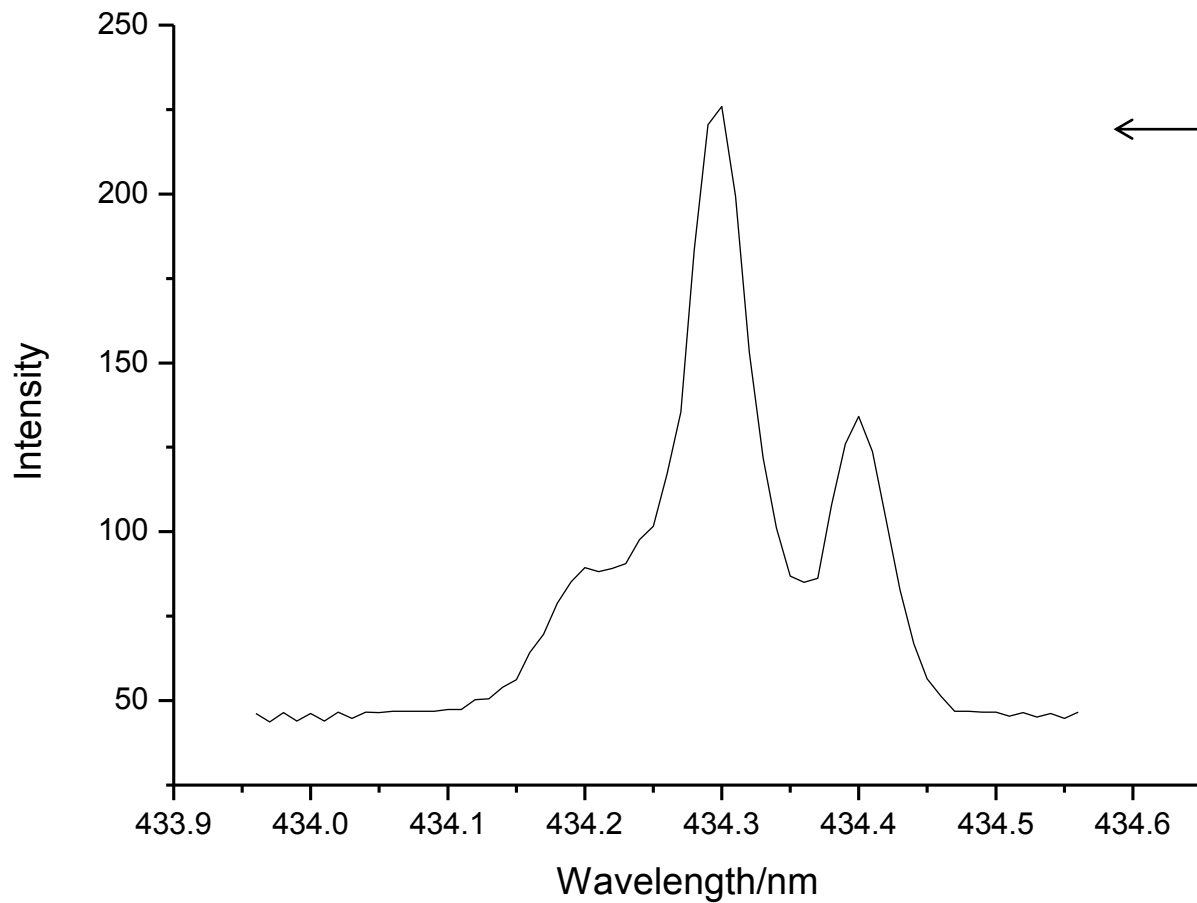
氢灯光谱 3- \rightarrow 2



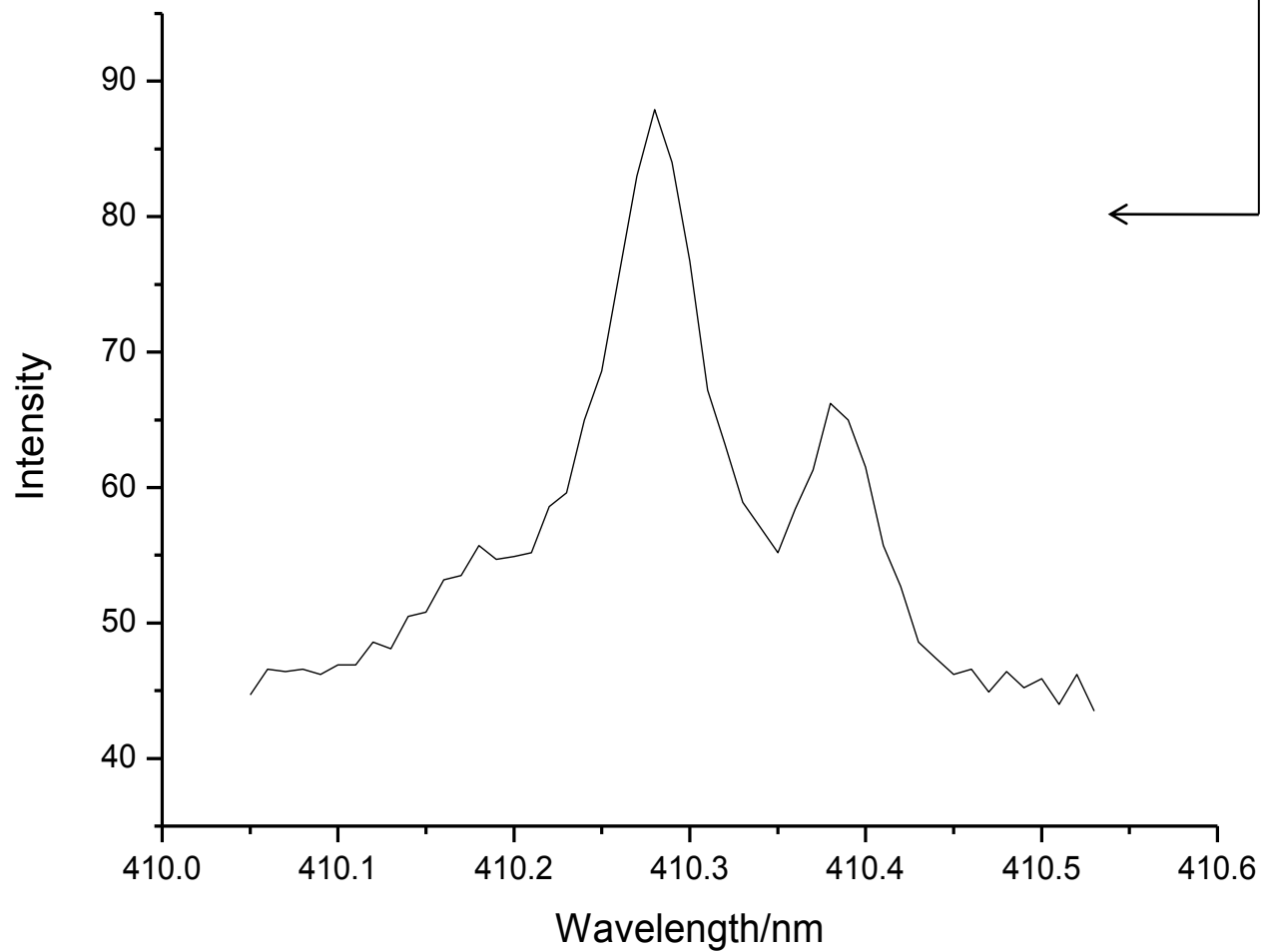
氢灯光谱 4->2



氢灯光谱 5- \rightarrow 2



氢灯光谱 6- \rightarrow 2



计算 m_D / m_e

已知 m_e / m_H .

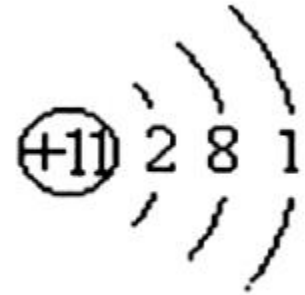
根据公式 $\frac{\lambda_H}{\lambda_D} = \frac{1 + m_e / m_D}{1 + m_e / m_H}$,

计算得到: $m_D / m_e = 3395.09$

真实值: $m_D / m_e = 3671.48$

类氢光谱，钠光谱

$$\nu = R_{\infty} \left(\frac{1}{(n_2 + \Delta_2)^2} - \frac{1}{(n_1 + \Delta_1)^2} \right)$$



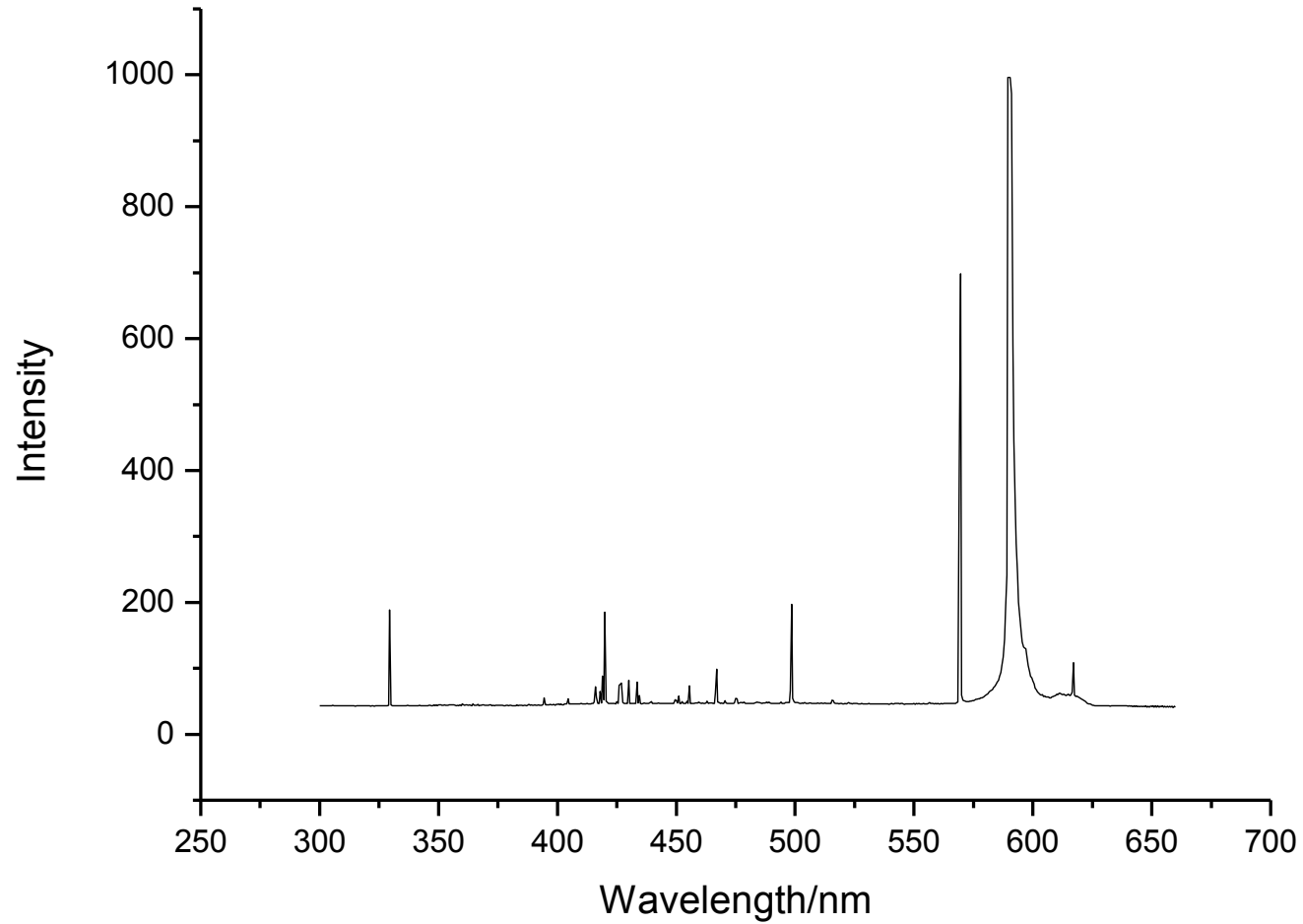
锐线系： $n^2 S \rightarrow 3^2 P$ 跃迁 ($n > 3$)

主线系： $n^2 P \rightarrow 3^2 S$ 跃迁 ($n \geq 3$)

漫线系： $n^2 D \rightarrow 3^2 P$ 跃迁 ($n \geq 3$)

基线系： $n^2 F \rightarrow 3^2 D$ 跃迁 ($n > 3$)

钠光谱



钠光谱分析

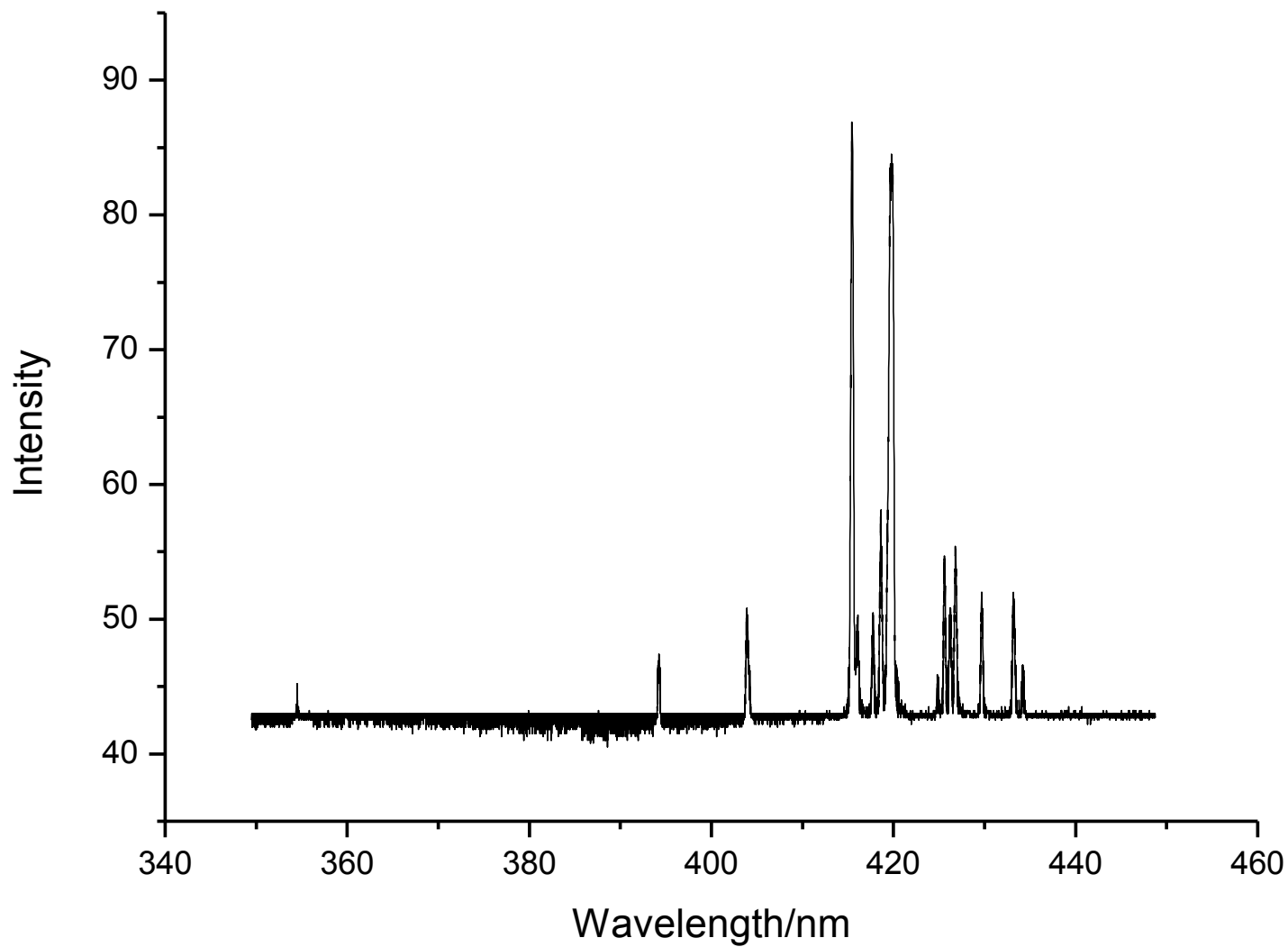
	测量值/nm	修正值/nm	对应跃迁
主线系	589.34, 589.94	588.354, 588.95	$3P \rightarrow 3S$
	329.14	329.796	$4P \rightarrow 3S$
锐线系	616.11, 616.72	614.955, 615.561	$4S \rightarrow 3P$
	454.31, 455.17	454.176, 455.031	$8S \rightarrow 3P$
漫线系	568.77, 569.27	567.914, 568.411	$4D \rightarrow 3P$
	498.27, 497.83	497.859, 497.422	$5D \rightarrow 3P$

量子缺计算

$$\nu = 1/\lambda = R_{\infty} \left(\frac{1}{(n_2 + \Delta_2)^2} - \frac{1}{(n_1 + \Delta_1)^2} \right)$$

	对应跃迁	波长/nm	量子缺
主线系	3P → 3S	588.65	-0.897425
	4P → 3S	329.80	
锐线系	4S → 3P	615.26	-1.35324
	8S → 3P	454.60	
漫线系	4D → 3P	568.16	-0.020808
	5D → 3P	497.64	

钠灯中的杂质-----Xe和Hg



钠光谱中的杂质

来源	波长/nm	强度
Hg	354.966	45.2
Xe	394.475	47.4
Hg	404.084	50.8
Xe	415.601	86
Xe	416.774	50.3
Xe	417.867	50.5
Xe	418.721	58.1
Xe	419.854	84.5
Xe	424.962	45.7
Xe	425.638	54.5
Xe	426.293	50.8
Xe	426.85	55.4
Xe	429.702	52
Xe	433.199	51.5
Xe	434.243	46.5

Thank you for your attention!