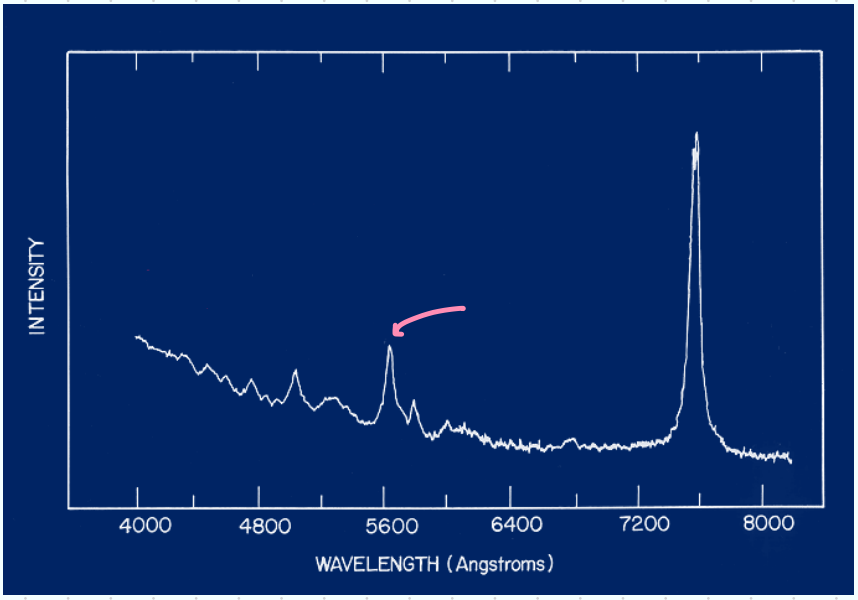
Student Question - Priti Finavia



The arrow shows an emission line of an object. The redshift of this object is 0.152

A) Find rest wavelength of the emission line.

$$\Rightarrow \quad z = \frac{\lambda_{obs} - \lambda_{rest}}{\lambda_{rest}}$$

$$0.152 = \frac{5600\,\text{Å} - \lambda_{rest}}{\lambda_{rest}} \quad \Rightarrow \lambda_{rest} = 4861.1\,\text{Å}$$

B) What transition does this wavelength correspond to, assuming it is hydrogen line.

$$\Rightarrow \quad E = \frac{hc}{\lambda} = \frac{1240\ \text{eV nm}}{486.11\ \text{nm}} = 2.55\,\text{eV}$$

$$E = -13.6\ \text{eV}\ \frac{1}{n^2}$$

$E_1 = -13.6$ eV $E_3 = -1.51$ eV

$E_2 = -3.4$ eV $E_4 = -0.85$ eV

so, $E_4 - E_2 = -0.85 + 3.4 = 2.55$ eV

Transition from $n = 4 \rightarrow n = 2$

C) Say the atom is not hydrogen, and the transition is from $n=4$ to $n=3$ what atom would this be?

$\Rightarrow$ $E_n = -13.6 \frac{Z^2}{n^2}$

$E_4 = -0.85 Z^2$ $\quad \frac{1}{n_f^2} - \frac{1}{n_i^2}$

$E_3 = -1.51 Z^2$

$E_4 - E_3 = 0.66 Z^2$

$2.55 = 0.66 Z^2$

$Z \sim 2$

likely He^+

D) Assume it emits like a blackbody. Find temperature.

$\Rightarrow$ $\lambda_{peak} = \frac{b}{T}$

$T = \frac{3 \times 10^{-3} \, mK}{4861.1 \, Å} = 617.1 \, K$

Typically quasars or HII regions have temperature $\sim 10^4 K$.