UNIVERSITY OF BIRMINGHAM

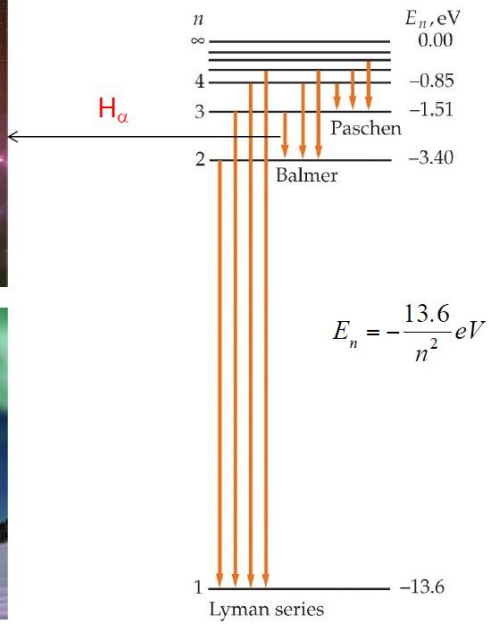
Recap of Lecture 3

- Failing of classical theories – Photoelectric effect & Compton Scattering
- No electrons emitted below threshold frequency
- Change in wavelength in scattered x-rays
- Photons, with $E=hf$, solve both issues

In this lecture

- The spectra of light emitted/absorbed by electrons in
  - Hydrogen (simple)
  - Bigger atoms (.. not simple)
- Electronic shells and orbitals

Emission spectra examples



Also, (old) sodium discharge streetlights:

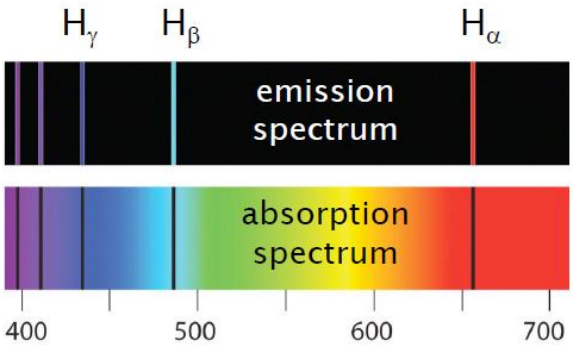
Relaxation process:

Vacancy in shell – higher energy raspberry can fall down into here, losing energy as radiation

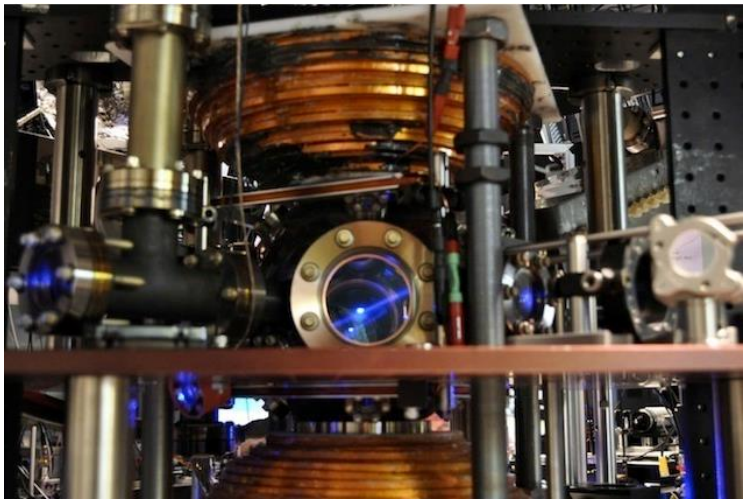
Balmer Series

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

- Balmer Series (n to 2 transitions)



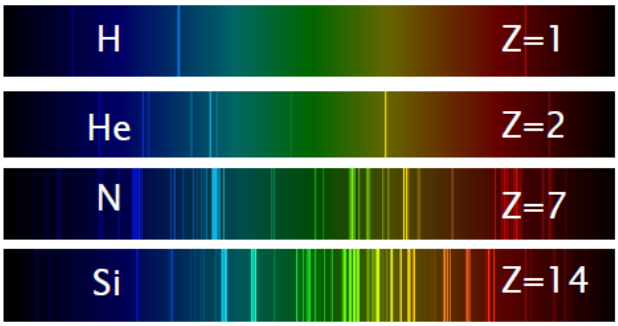
Cold atoms



The cold atoms group at UoB uses the sharp, exact energy spacing of atomic levels in ultracold gases of rubidium atoms to e.g. measure gravity, simulate big bang conditions…

Bigger atoms

- Increasing complexity



- Sodium (Z = 11) energy levels