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Doppler Effect:

Radial motion **away** from us shifts the wavelength of light to **longer** (redder) wavelengths

Radial motion **towards** us shifts the wavelength of light to **shorter** (bluer) wavelengths.

We experience the same effect with **sound waves** (think of a train horn, or ambulance siren as it passes); it is known as the **Doppler Effect**.

Doppler shift formula (OK if v << c)

Change in wavelength (can be +ve or –ve)

Radial velocity (can be +ve or –ve)

$$\frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

Wavelength of light as measured in the laboratory

Speed of light

Spectral Lines:

These are produced when photons of light interact with the electrons in atoms. (See A1Y Stellar Astrophysics for details).

An **emission line** is produced when an electron drops from a **higher energy level** to a **lower energy level**. (See left panel below). This produces a photon of light with an energy exactly equal to the difference between the electron energy levels. Hence we observe light at a precise **frequency**, or **colour**, corresponding to this photon energy.

An **absorption line** is produced when an atom absorbs a photon from its surroundings. This causes an electron to jump from a **lower energy level** to a **higher energy level**. (See right panel below). Hence, light of the precise frequency (I.e. colour) corresponding to the absorbed photon will be **missing** from the observed spectrum.