Doppler Broadening.

The distribution of one component of velocity in a gas is readily observed via the Doppler Effect.

- For a narrow transition at frequency ν_0, each atom emmits at ν_0 in its own rest frame.

- If an atom is in motion at velocity $\vec{v}$ relative to lab.

$$(\nu - \nu_0) = \frac{v_x}{c} \nu_0$$

- Since v_x follows a Gaussian distribution.
  the light observed should have a range of frequencies.

- Frequency distribution $g(\nu)$.

$$g(\nu) = f_x(v_x) \left| \frac{dv_x}{d\nu} \right| = \frac{c}{\nu_0} N e^{\frac{-mc^2(\nu-\nu_0)^2}{2k_0 T \nu_0^2}}$$

standard deviation: $\sigma_\nu = \frac{\nu_0}{c} \sqrt{\frac{k_0 T}{m}}$