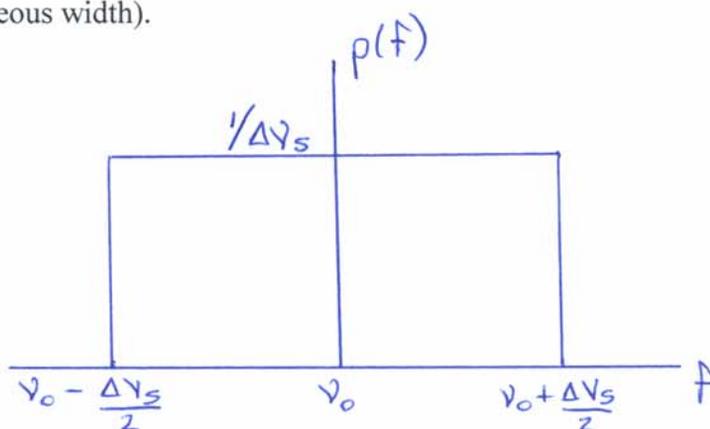


Assignment 5

1. Estimate the frequency difference of hydrogen and deuterium lines for the Lyman alpha transition.
2. Collisions shorten the radiative lifetime and thereby increase the spectra linewidth. Estimate the mean time between collisions for a gas of atoms at room temperature and at pressure of 10^{-6} torr.
3. Suppose the distribution of center frequencies f is a "square" function for those values $\nu_0 - \Delta\nu_s/2 < f < \nu_0 + \Delta\nu_s/2$, and zero otherwise as shown below. Each group of atoms $p(f) df$ is characterized by a Lorentzian with a width $\Delta\nu_h$ (i.e. a homogeneous width).



- a) Derive an analytic expression for the combined lineshape.
 - b) Plot the lineshape as a function of frequency for a ratio $\Delta\nu_h / \Delta\nu_s = 0.01, 0.1$ and 0.5
4. Evaluate the Doppler widths of the following helium-neon transitions in GHz and in nm.
 - a) $3s_2 - 2p_4$ at 632.8 nm
 - b) $2s_2 - 2p_4$ at 1.15 μm
 - c) $3s_2 - 3p_4$ at 3.39 μm