Homework #3 Due 9/20/2023

(1)

Go to the literature and find data for an atomic or molecular transition in the 200 – 500 nm region where the cross section for collision broadening (2γ from our notes, or anything from which 2γ can be derived) is calculated or measured. Any bath gas is fine, but note which gas or gas mixture it is.

For that transition, calculate the natural, collision, and Doppler linewidths at 300 K and 1 atm, as well as at 2500 K and 1 atm. Express the answer in nm, wavenumbers, and Hz.

(2)

Repeat (1) above for a transition in the 1 to 10 micron range.

(3)

For NO in N_2 at 1500 K and 1 atm for a line at 225 nm, plot the expected lineshape function that you would use considering:

i) Only Doppler broadening
ii) Only collision broadening
iii) Both Doppler and collision broadening

Use the constants and relations in the class notes (or look up better ones in the literature). Plot all three lineshapes on the same graph, and spread out your plot so that differences between the three curves are clearly apparent. For iii), describe in detail how you did the calculation. You may use existing routines, numerical integration, or high level approximate methods. But you need to show your approach in detail. Do not use a "pseudo-Voigt" approximation.