

Exercise No. 3 – Line shape

You can use the plotting script from the previous exercises as a starting point for this exercises. Copy it to this directory and adapt it for the upcoming questions.

1. Choose an individual line and perform calculations over a restricted frequency range for a number of different pressures. Keep the temperature and constituent mixing ratio constant.

How does the shape of the spectral lines change?

By now we investigated absorption in terms of the absorption cross-section σ . Another widely used unit is the absorption coefficient α . It takes the number concentration n of the absorber into account:

$$\alpha = n \cdot \sigma$$

How does the absorption coefficient in the line centre change, if pressure is changed?

2. The full-width at half maximum (FWHM) is a measure of the line width. Typhon provides a function `typhon.spectroscopy.linewidth()` to calculate the FWHM for a given absorption spectrum. Make a plot of this as a function of altitude (pressure) for a microwave line and an infrared absorption line.