Advanced radiation and remote sensing

Manfred Brath, Oliver Lemke, Stefan Bühler

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Exercise No. 2 – Vibration

You can reuse the jupyter notebook from the first exercise to answer the questions on vibrational spectra. First, copy the Jupyter notebook and the python module from the last exercise into the directory of exercise no. 2:

```
$ cd ~/arts-lectures/exercises/02-vibrational_spectra/
$ cp ../01-rotational_spectra/absorption.ipynb vibration.ipynb
$ cp ../01-rotational_spectra/absorption_module.py vibration_module.py
```

Next, you have to adjust the frequency limits. For plotting in the infrared range, it is common to use wavenumber in $\left[\mathrm{cm}^{-1}\right]$ instead of frequency. Adapt the plotting part of your Jupyter notebook accordingly.

1. Find the fundamental band of CO and plot its spectrum.
   - Determine the band center frequency $\hat{\nu}$ from your plot.
   - There is some "pollution" in the P-branch that comes from lines of ^{13}CO. Recalculate the spectrum for the main isotopologue only by setting the species to "CO-26". What does the "-26" suffix mean?
2. Explore the spectrum of either H_2O or CO_2. Can you find the different vibration bands?