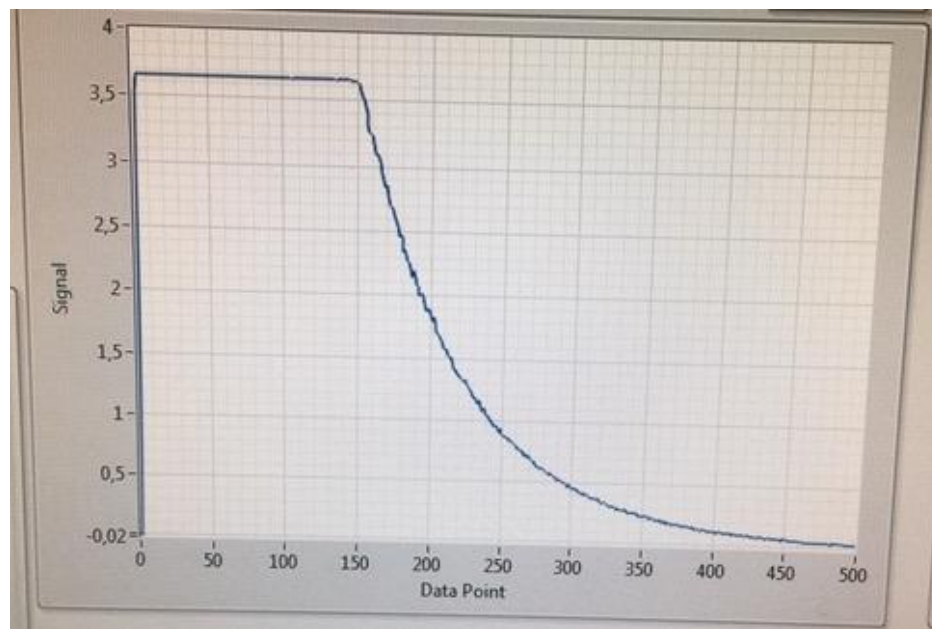
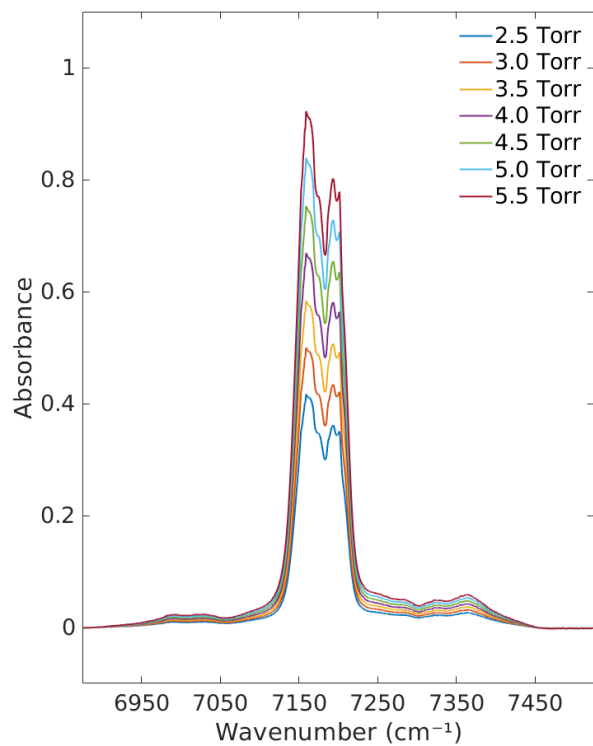


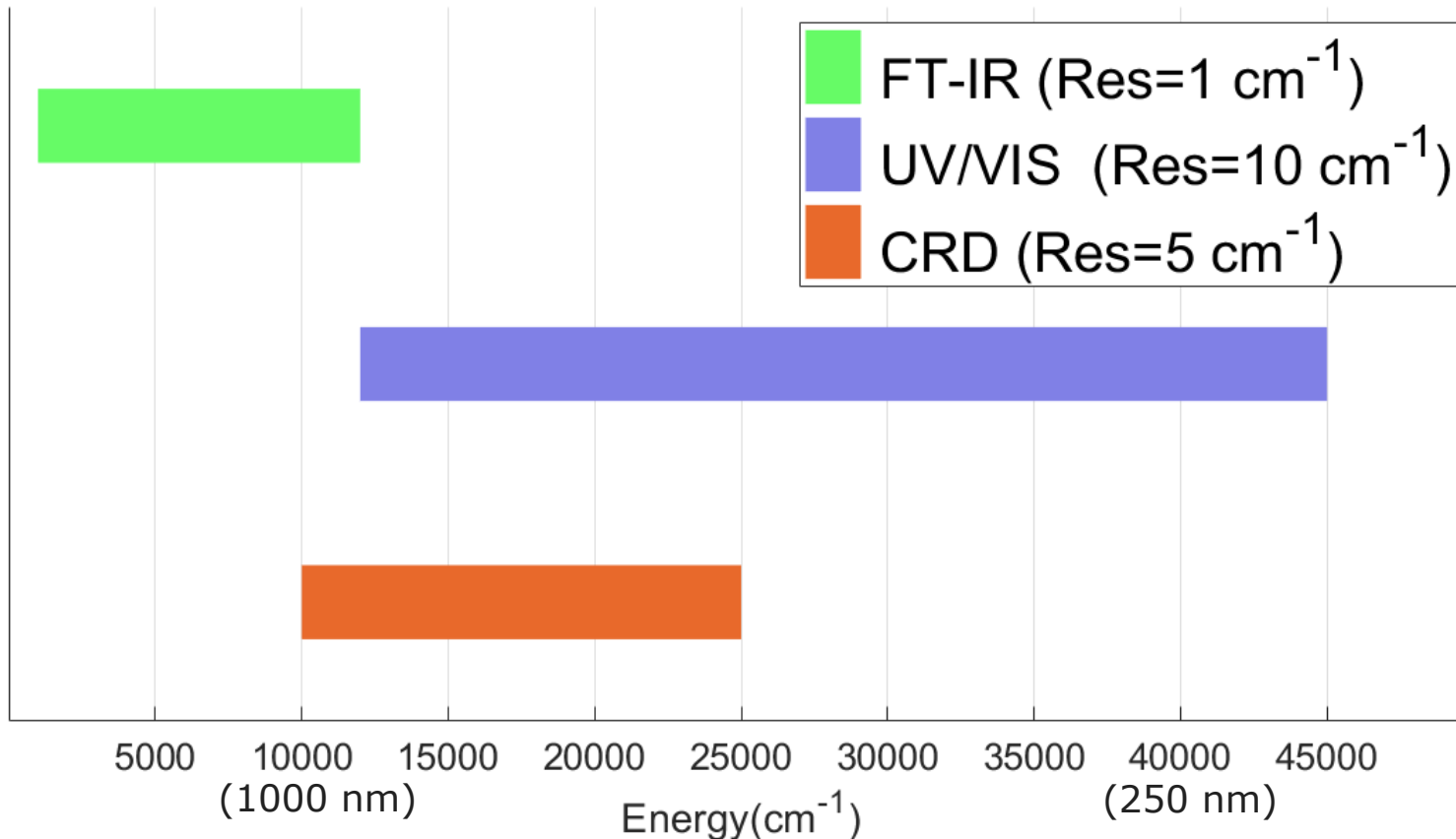


## Vibrational transitions: Experimental section

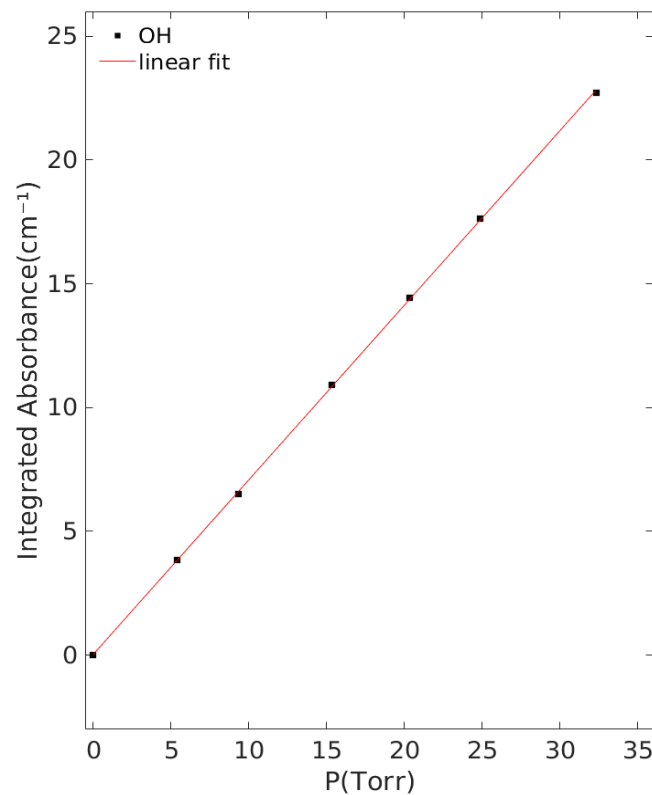
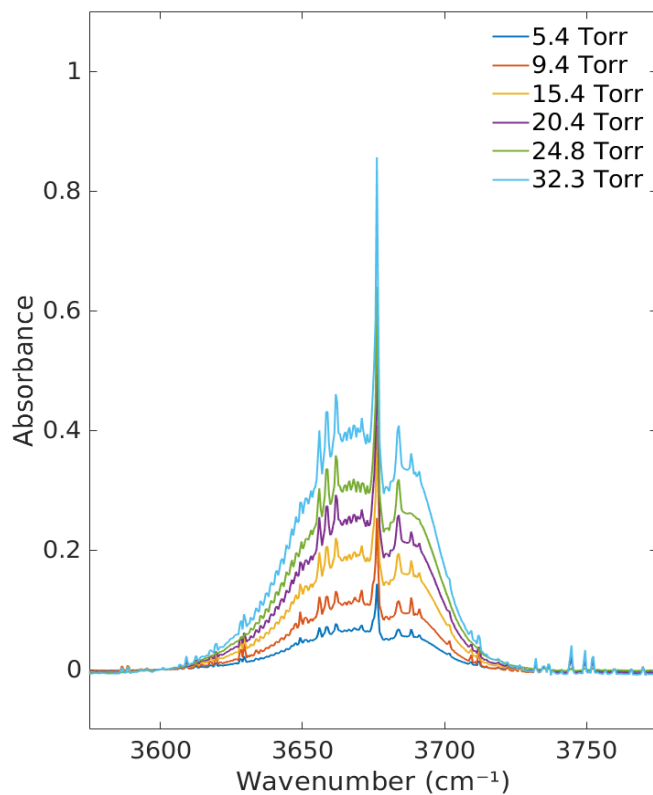


## Instruments used to measure vibrational transitions

- **Fourier Transformed Infrared Spectroscopy (FT-IR).**
- **Ultraviolet Visible Spectroscopy (UV/VIS)**
- **Cavity Ring down Spectroscopy (CRD).**



# Intensities of transitions

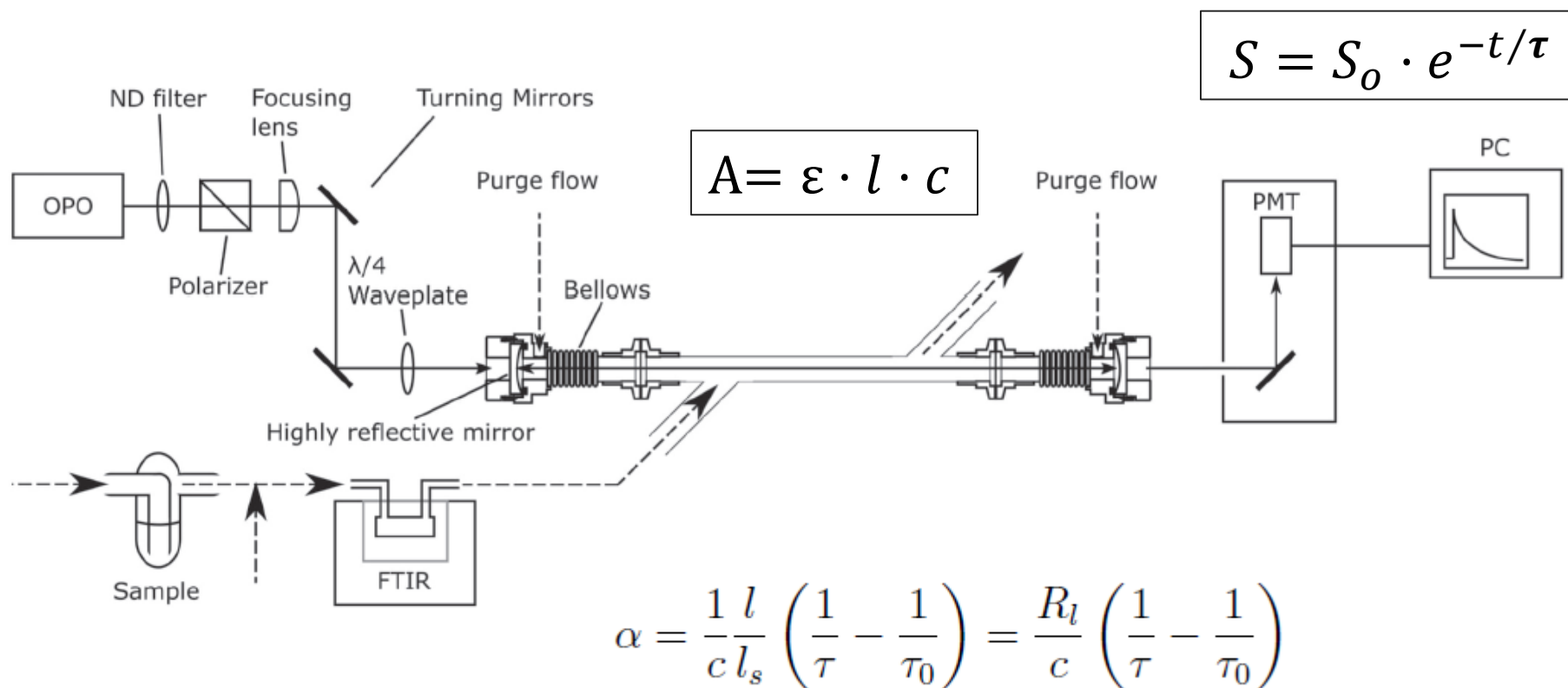


Transition	f
Fundamental	2.36E-6
First overtone	5.45E-7
Second overtone	2.54E-8

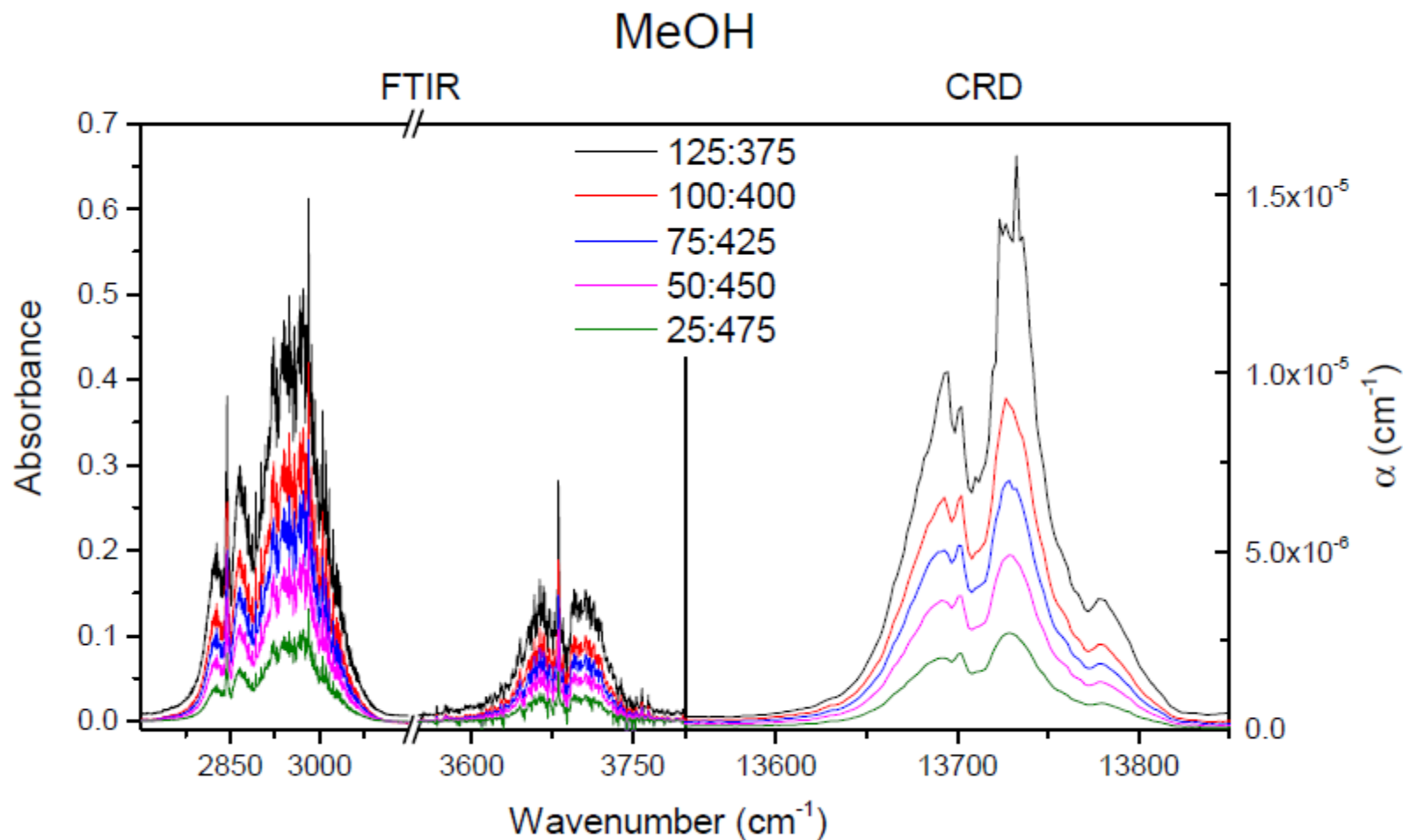
$$\int A(\tilde{\nu})d\tilde{\nu} = \frac{f_{FTIR} \times l}{2.6935 \times 10^{-9} \text{ K}^{-1} \text{ Torr m cm} \times T} \times p,$$



# CRD Spectroscopy



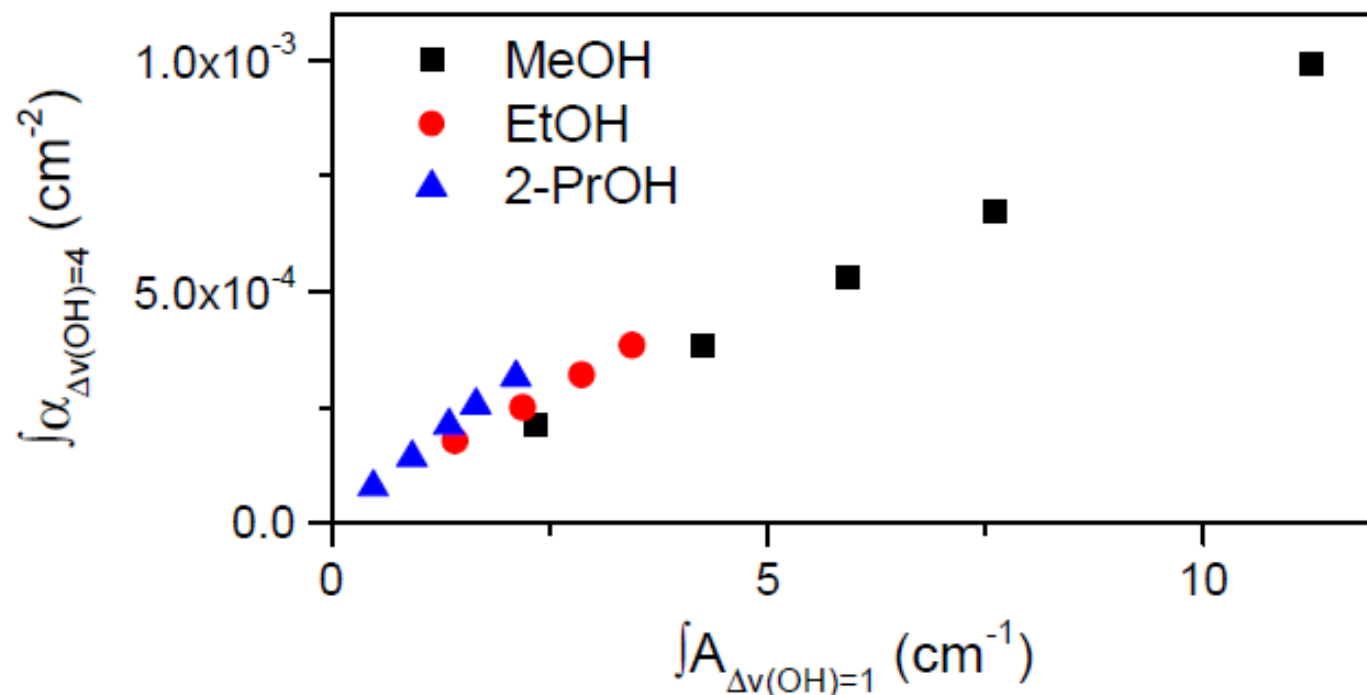
## CRD Spectroscopy



$$\alpha = \frac{1}{c} \frac{l}{l_s} \left( \frac{1}{\tau} - \frac{1}{\tau_0} \right) = \frac{R_l}{c} \left( \frac{1}{\tau} - \frac{1}{\tau_0} \right)$$



## Intensities calculation



$$\int \alpha_{CRD}(\tilde{\nu}) d\tilde{\nu} = \frac{f_{CRD}}{f_{ref}} \frac{\ln(10)}{l_{ref}} \int A_{ref}(\tilde{\nu}) d\tilde{\nu}$$

## Exoplanet applications

**NIR measurements** of some atmospheric molecules with a CRD:

1. Small hydrocarbons (Isoprene)
2. Organic molecules with functional groups (alcohols, aldehydes..).

### **Objectives:**

- Calculation of abundances in the atmosphere (Intensities).
- Characterization of molecules (conformers, frequencies, shape of the peak...).

