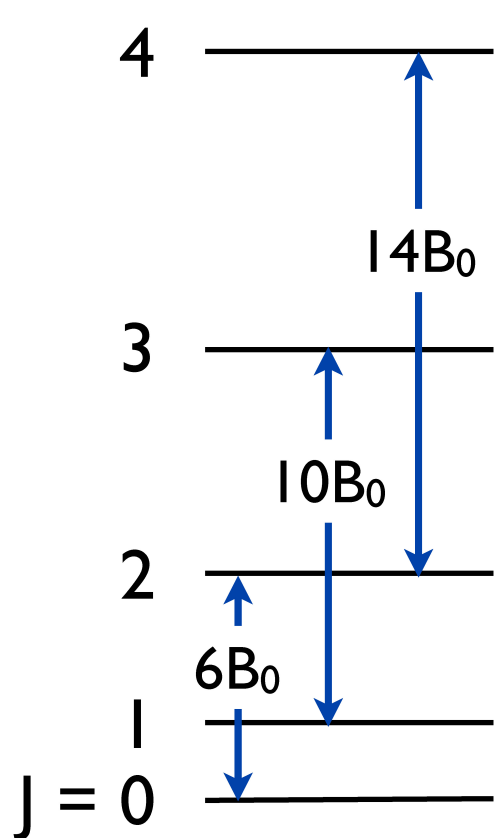


Rotational Raman Scattering of Air, Oxygen and Breath

09/05/2014

Rotational Raman Scattering of Linear Molecules



Rotational
energy Level

$$E_J = J(J + 1)chB_0$$

-Transition

$$J \rightarrow J+2 \text{ (Stokes)}$$

$$J+2 \rightarrow J \text{ (AntiStokes)}$$

-Frequency

$$(4J+6)B_0 \quad (J \rightarrow J+2)$$

$$-(4J+6)B_0 \quad (J+2 \rightarrow J)$$

B_0 [cm^{-1}]: Rotational constant

ex. N_2

$$B_0 = 1.98973 \text{ cm}^{-1}$$

$$0 \rightarrow 2: 11.938 \text{ cm}^{-1} \quad 1 \rightarrow 3: 19.897 \text{ cm}^{-1}$$

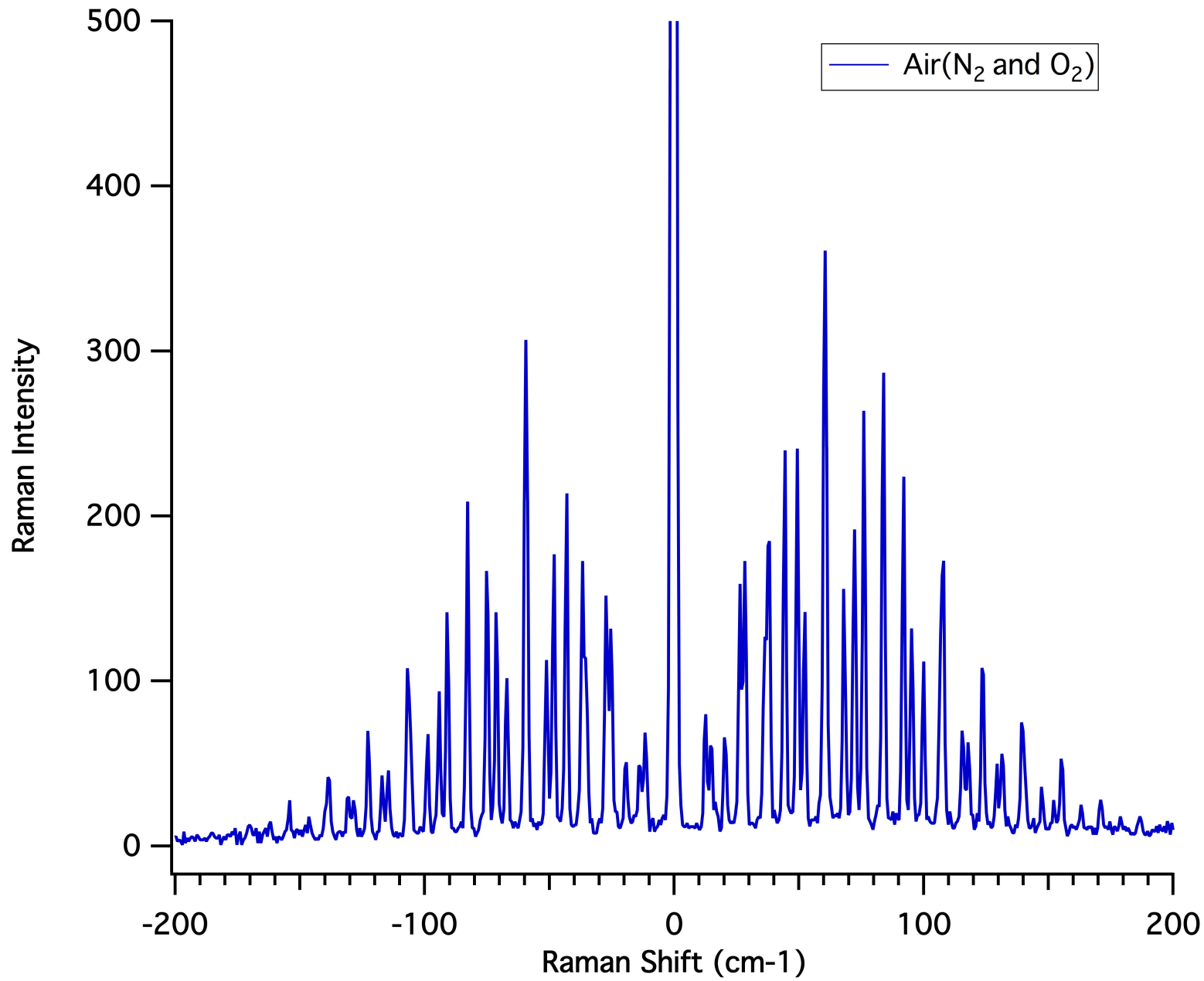
$$2 \rightarrow 4: 27.856 \text{ cm}^{-1} \quad 3 \rightarrow 5: 35.815 \text{ cm}^{-1}$$

Detectable with a low frequency
Raman spectrometer

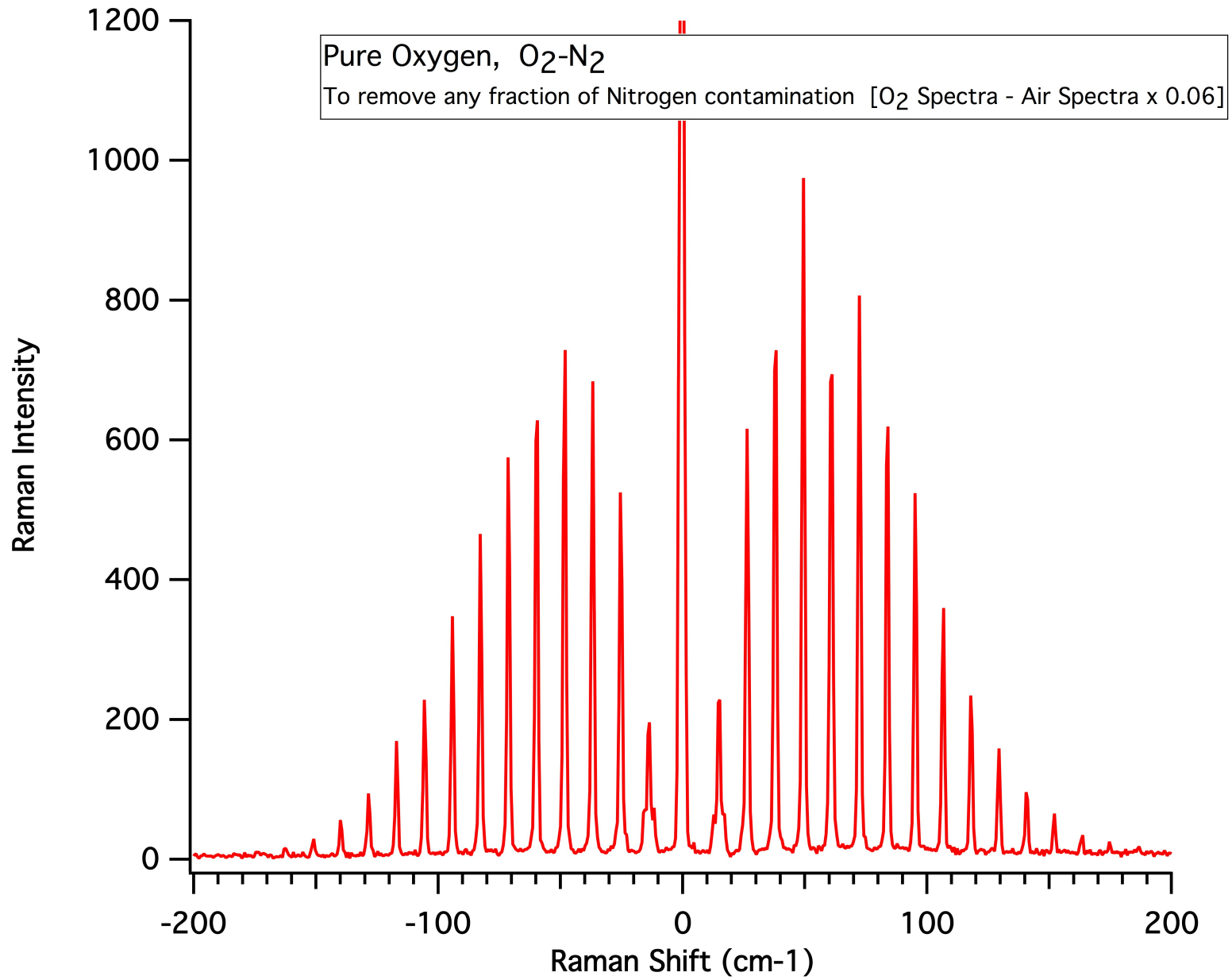
Experimental Setup

- Sealed Glass cuvette with balloon and vacuum pump setup
- 532nm, 19mW at Sample
- Objective: 20x, 0.4 NA
- Spectral Resolution: 1.3 cm⁻¹
- Exposure: 60sec

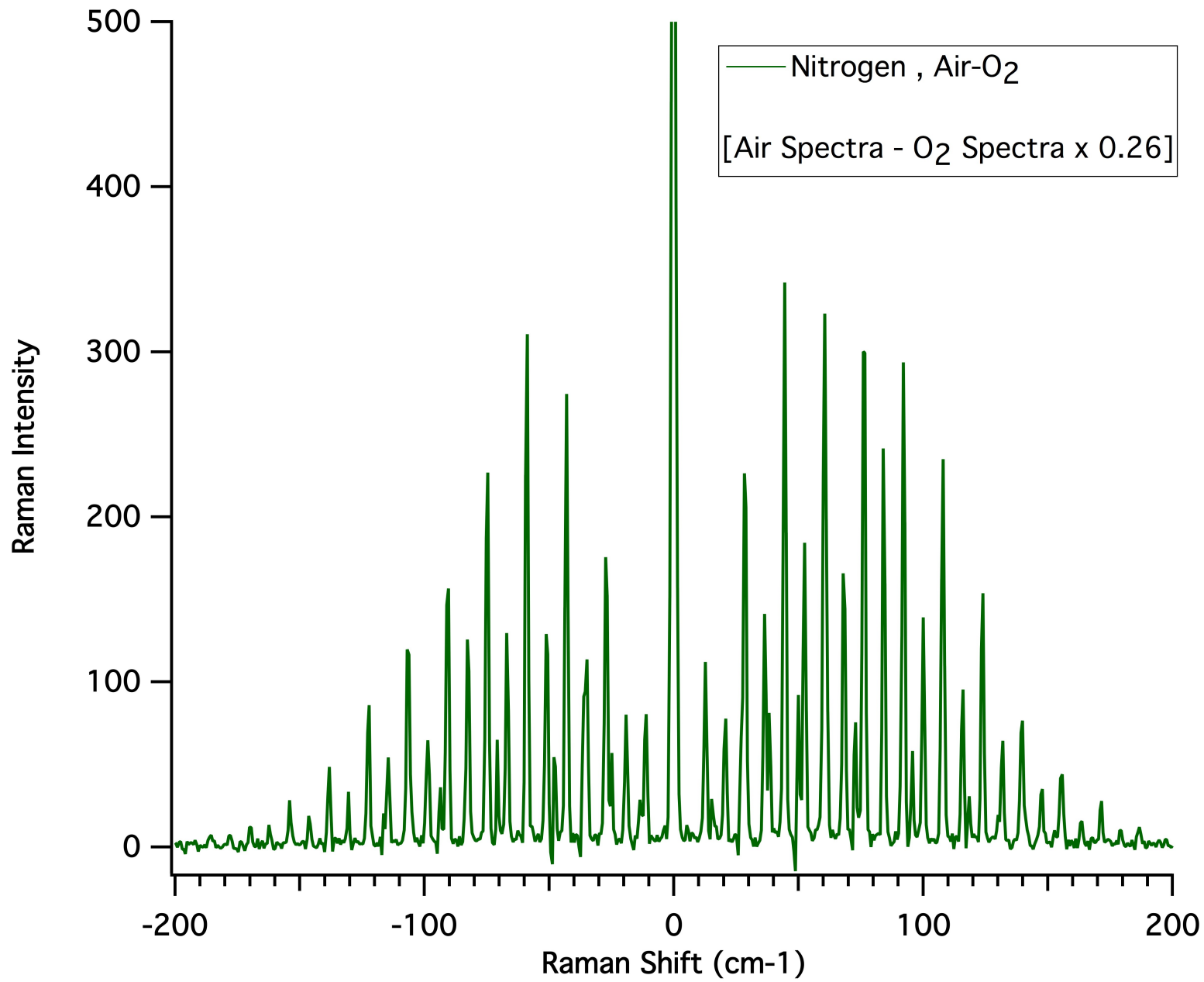
Raman Spectra of Air



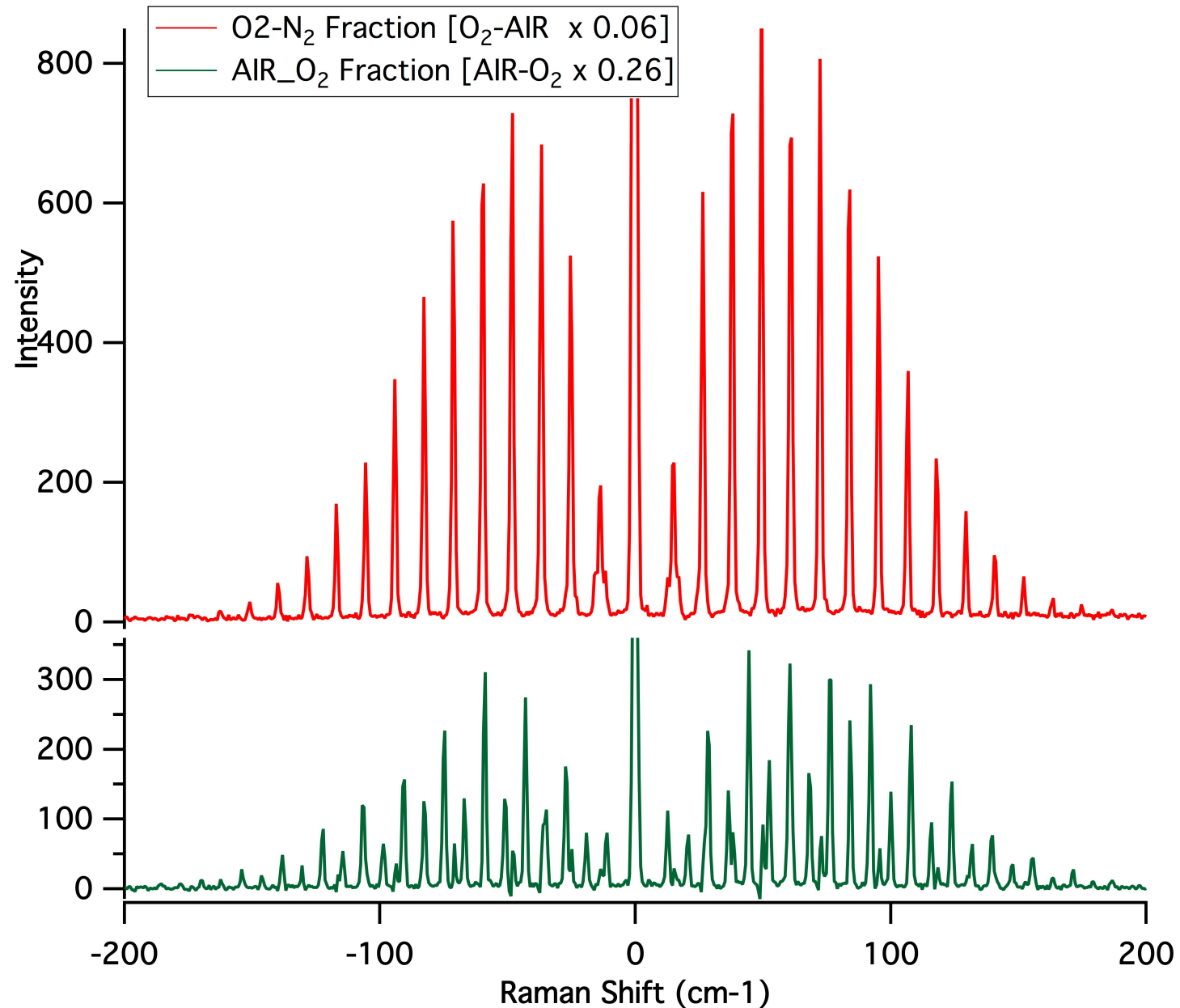
Oxygen (after removing N₂ fraction)



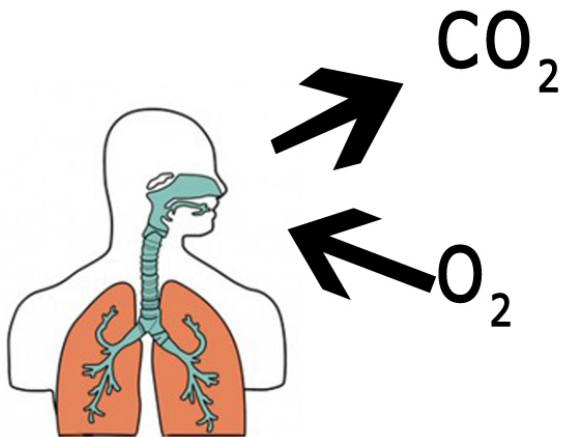
Nitrogen (Air-O₂ x Factor)



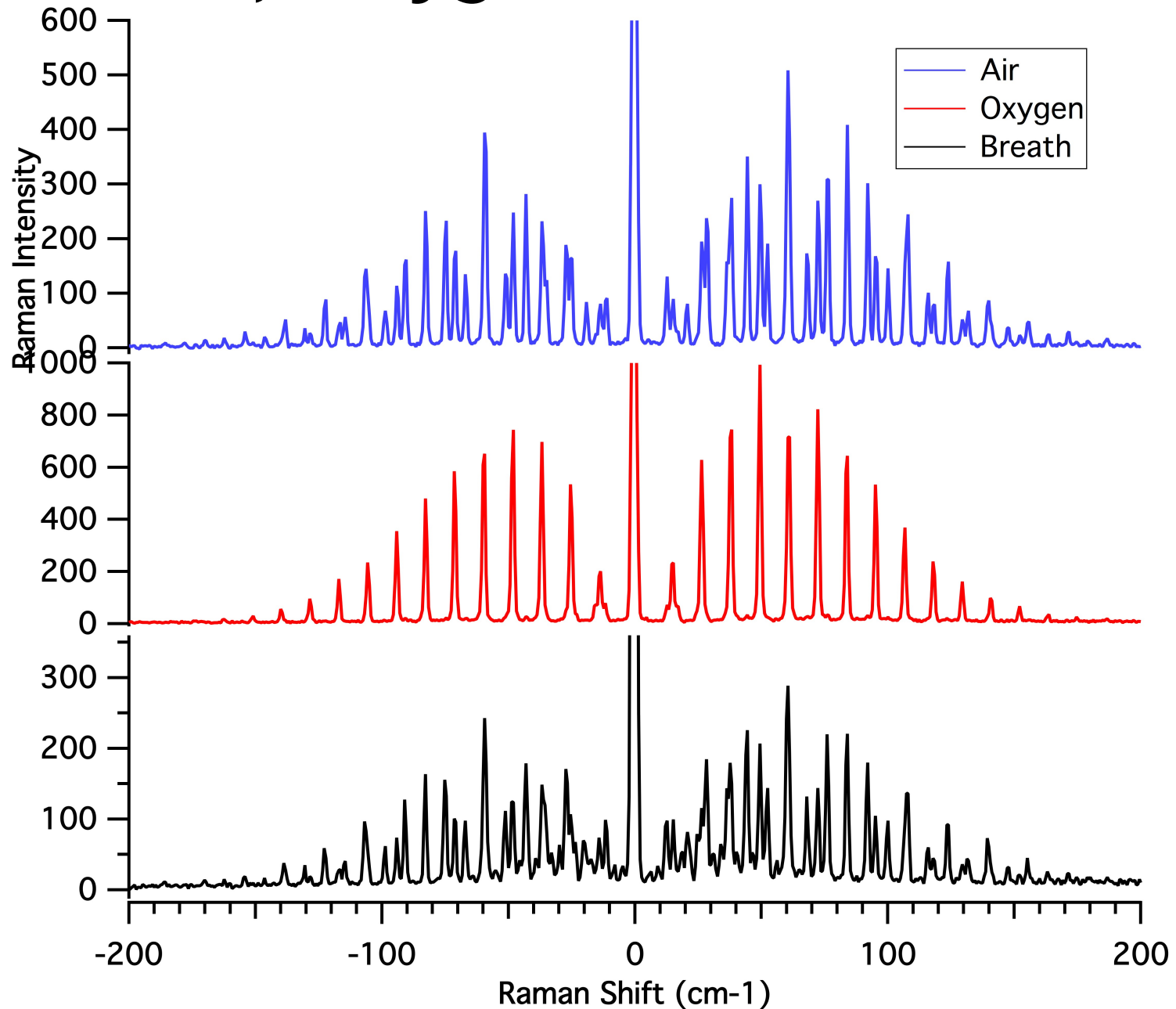
Oxygen and Nitrogen Comparison



Raman measurement of breath

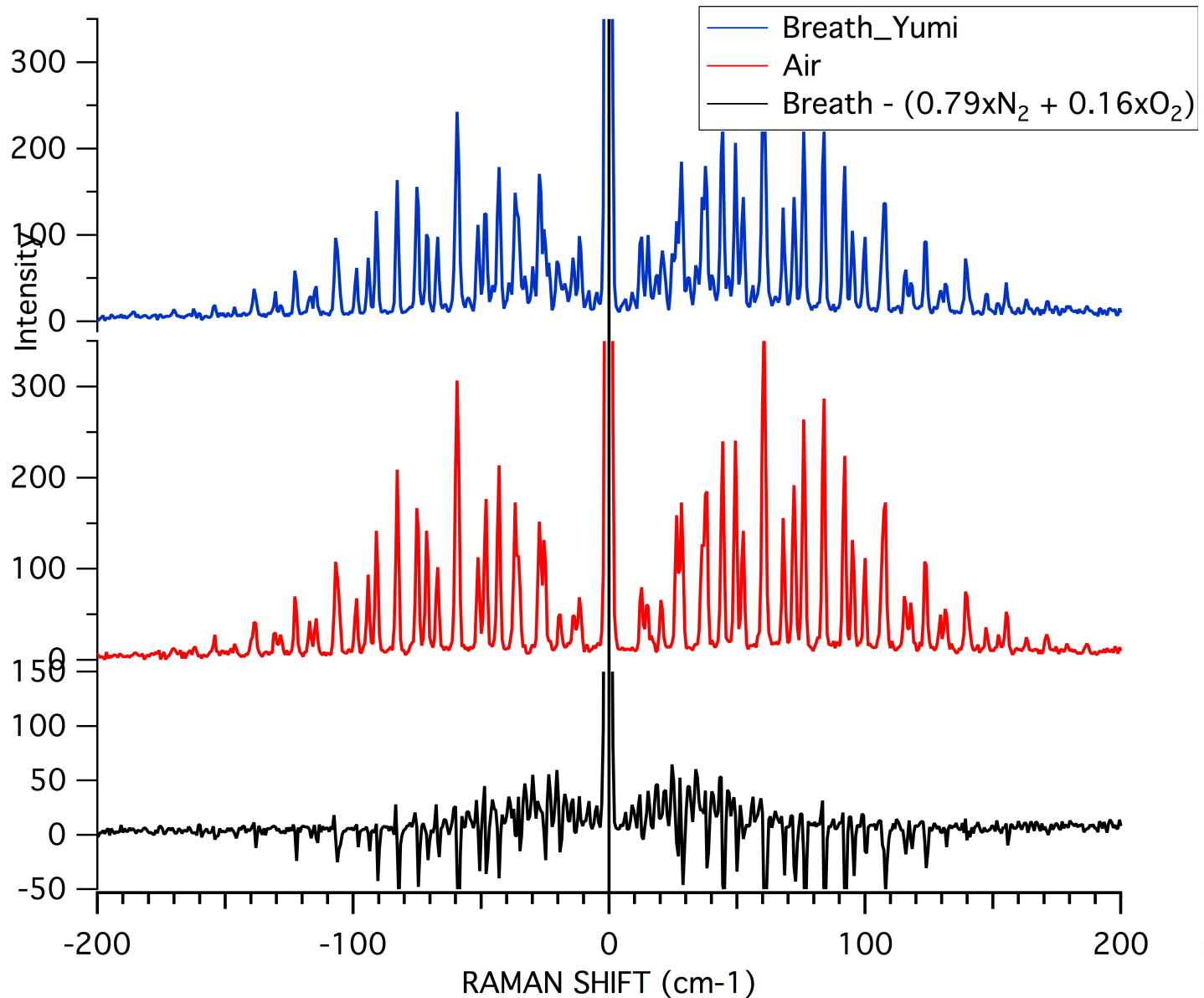


Air, Oxygen and Breath



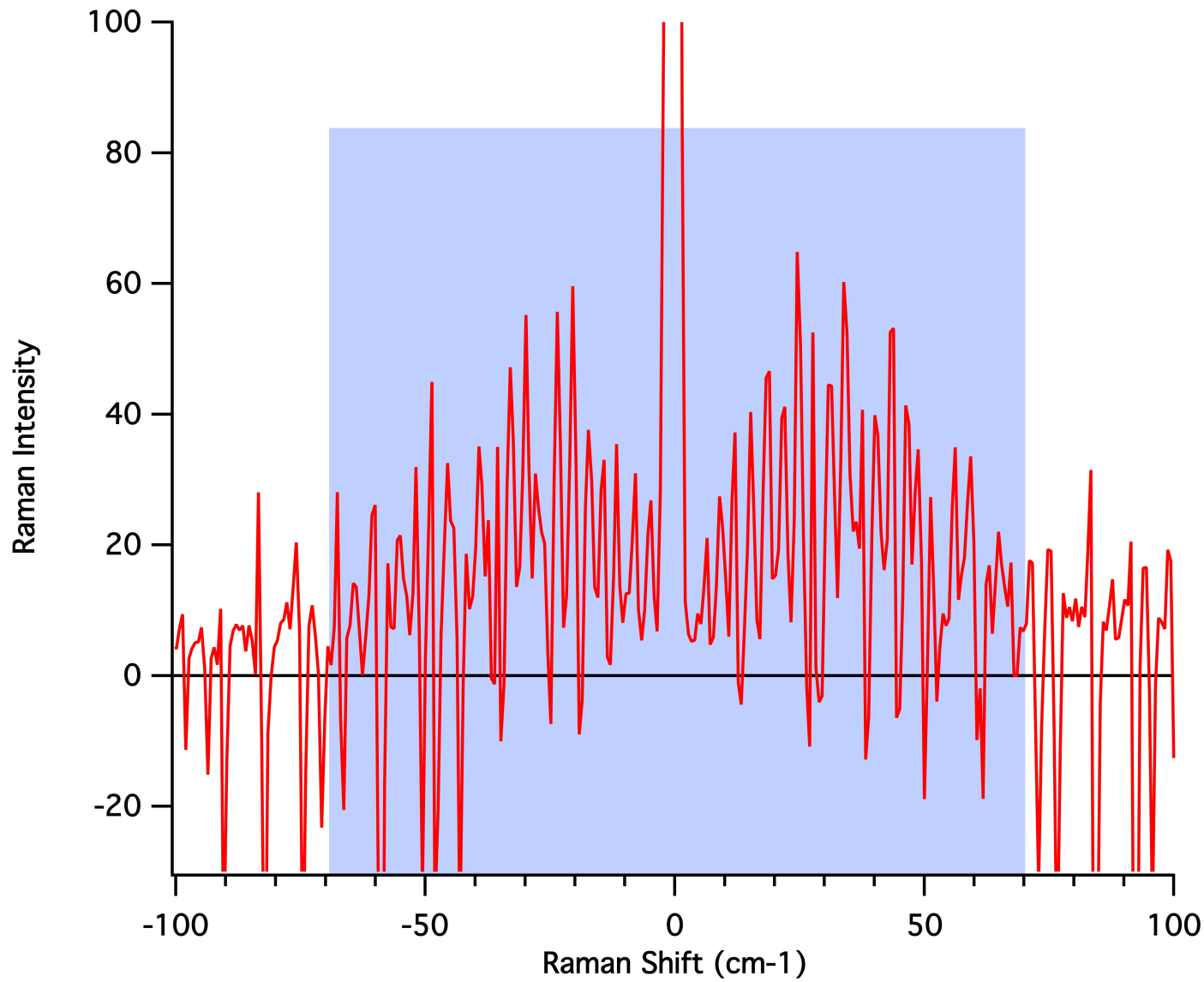
CO₂ Spectra

(Subtraction of N₂ and O₂ Spectra from Breath spectra)

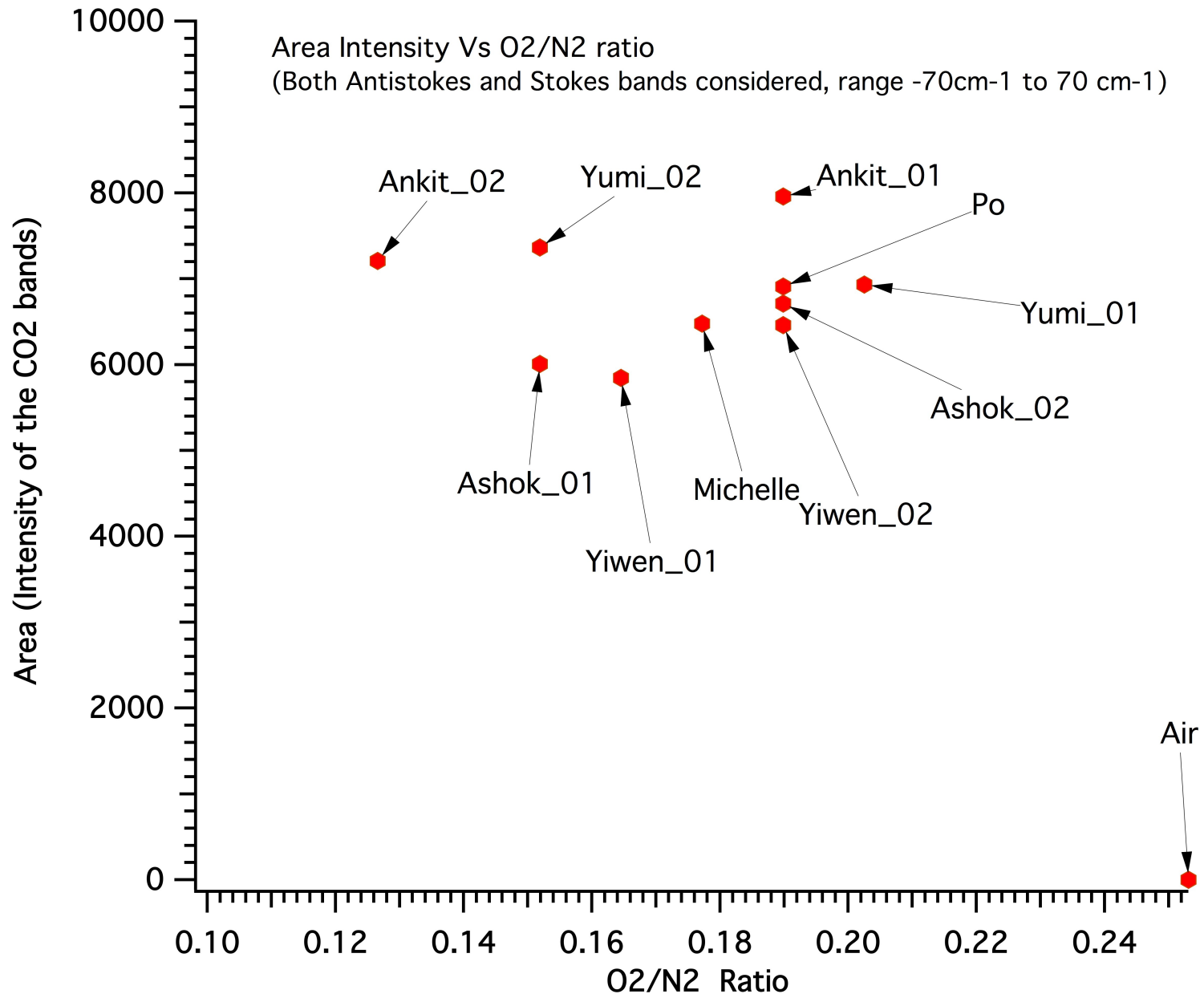


CO₂ Spectra

Area of the intensity is used for comparison
[-70cm⁻¹ to 70cm⁻¹]



Comparison between Breath Samples



Comparison between Breath Samples

