WATER BROADENING OF OXYGEN

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A need for precise air-mass retrievals utilizing the near-infrared O_2 A-band has motivated measurements of the water-broadening in oxygen. Experimental challenges have resulted in very little water broadened oxygen data, especially in the near-infrared where pressure broadened linewidth must compete with the relatively large thermal linewidth. Existing water broadening data[a] for the O_2 A-band is of insufficient precision for application to the atmospheric data. Because of the nature of scattering processes, it is believed that broadening parameters for O_2 from one spectral region may be transferable to other spectral regions - so we investigated the O_2 60 GHz magnetic dipole Q branch which is also used prominently in remote sensing. Atmospheric retrievals of air-mass and temperature that use the 60 GHz magnetic dipole Q branch incorporate a water-broadening parameter that is scaled to self-broadened values, but there is only high temperature data that directly supports this hypothesis.[b] We present precise O_2-H_2O broadening measurements for the magnetic dipole Q-branch and the pure-rotational band, measured at room temperature with a Zeeman-modulated absorption cell and a frequency-multiplier spectrometer. Here we will describe the apparatus and the measurement analysis. Inter-comparisons of these and other O_2 broadening data sets confirm the expectation of only minor band-to-band scaling of pressure broadening. The measurement provides a basis for fundamental parameterization of retrieval codes for the long-wavelength atmospheric measurements. Finally, we encourage the application of these measurements for retrievals of air-mass *via* remote sensing of the oxygen A-band.

[a] E.M. Vess *et al. J. Phys. Chem. A* 116, 4069-4073 (2012).
[b] G. Fanjoux *et al. J. Chem. Phys.* 101(2) 1061-1071 (1994).