Pressure broadening of oxygen lines in the 60-GHz band: effects of perturber and temperature

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Oxygen is one of the major absorbers of the atmosphere. Oxygen lines, in particular fine-structure transitions of the 60-GHz band, are used for retrievals of atmospheric temperature from satellites, aircrafts and ground-based radiometers. Accuracy of the retrieved parameters depends directly on accuracy of spectroscopic parameters of the lines taken into account in atmospheric absorption models.

In the present study, pressure broadening of the 60-GHz band lines was measured using spectrometer with radio-acoustic detector [1] at relatively low pressure when all the lines of the band are resolved and can be studied separately. Gas cell was placed in a double magnetic shielding made of annealed permalloy to decrease influence of the magnetic fields on profiles of oxygen lines. The Julabo thermostat was used for the cell temperature control with 0.01^0C accuracy.

The effect of temperature and perturber on broadening coefficients of oxygen lines was studied. Measurement shows strong rotational dependence of oxygen line widths obtained in our earlier study for the case of self-broadening [2]. For the first time, temperature dependence of self-broadening parameters was accurately measured for a number the lines of the 60-GHz band in a wide range of rotational quantum number. Measurements revealed rotational dependence of the temperature exponent that should be taken into account for accurate modeling the band profile in a wide temperature range.

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