RAMAN SCATTERING FROM GASEOUS MOLECULES AND ITS APPLICATION TO UPPER ATMOSPHERE RESEARCHES

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ABSTRACT

The Raman scattering cross section is measured for gaseous molecules at a scattering angle of 90° in a direction perpendicular to the polarization vector of an incident beam. The depolarization of Raman scattering is also estimated by analysing the polarization of the scattered light. From the combination of the measured depolarization with the ratio of the scattered intensity in the Raman scattering to that in the Rayleigh scattering, the Raman scattering cross section is estimated for O_2, N_2, CO, and CO_2 and is tabulated in the following Table. A discussion will be given of the possibility of measuring the upper atmospheric composition on the basis of the Raman scattering.

Raman scattering cross section and depolarization ratio

Gas	Vibrational Frequency cm^{-1}	Measured Depolarization Ratio $\times 10^{-1}$	Measured Cross Section $\times 10^{-31} cm^2$ (Q-branch)	Measured Cross Section $\times 10^{-31} cm^2$ (Total)
CO_2	1285	1.4 ± 0.5	2.2 ± 0.3	2.8 ± 0.5
CO_2	1388	1.5 ± 0.5	3.1 ± 0.3	4.0 ± 0.6
O_2	1556	1.8 ± 0.2	2.4 ± 0.2	3.3 ± 0.3
CO	2145	1.4 ± 0.1	2.3 ± 0.3	2.9 ± 0.4
N_2	2331	1.0 ± 0.1	2.1 ± 0.3	2.5 ± 0.3