N87-10323

ROTATIONALLY RESOLVED COLLISIONAL TRANSFER RATES IN OH

Thomas J. McGee, James Butler[1], John Burris and William Heaps
NASA Goddard Space Flight Center Laboratory for Atmospheres
Greenbelt, Maryland U.S.A.
[1]Sciences Applications Research, 4400 Forbes Boulevard
Lanham, Maryland U.S.A.

Fluorescence lidar measurements of the hydroxyl radical require detailed information concerning collision-induced processes in order to deduce the radical number density from a lidar return. The GSFC OH lidar currently utilizes a braodband detector which precludes the necessity of fully understanding collisional redistribution of rotational energy within the excited state. Numerous advantages result however from the inclusion of a detector with a bandpass only slightly larger than the Doppler width of a rotational line. This however places more stringent requirements on the spectroscopy. We have accordingly made measurements of rotationally resolved quenching rates for collisions with O_2, N_2, and H_2O. We have also measured rotational transfer rates for the same colliders.

Quenching rates have been measured using a Nd-YAG pumped Rh6G dye laser doubled into the UV. The measured linewidth at 2820 Å was 0.009 Å. Emission from the excited state was filtered through a 0.6 m monochromator with a 1 Å bandpass. This insured that only the laser-excited rotational level was observed. The output of the PMT was fed into a transient digitizer with a 10 nsec bin size. The OH radicals were produced in a flow system by the reaction:

$$H + NO_2 \rightarrow OH + NO$$

The OH lifetimes were measured as a function of pressure of quenching gas at total pressures of between 50 and 250 microns. Quenching rate constants were measured from the slope of Stern-Volmer plots of the lifetimes data.

Rotational transfer rates have been measured by recording the emission spectrum on an intensified diode array and integrating over 10,000 laser shots. Spectra are recorded as a function of quencher pressure and rates are extracted from an analysis of the growth rate of emission from collisionally populated rotational levels.