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Fluorescence Model of Water Hot-Bands in Comets

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Water (H_2O) is dominant species in cometary ices and quite important as the baseline of chemical mixing ratios of cometary materials. In spite of abundant water in cometary comae around 1 AU from the Sun, emission lines from water molecules would be absorbed by the telluric atmosphere. Fortunately, the hot-band emission lines of water in infrared are not absorbed so much by the atmosphere. Therefore, we usually observe the hot-band emission lines from the ground-based observatories to observe water molecules.

Here, we present accurate fluorescence model of water hot-bands in comets. We assume thermalized ground vibrational state and excitation by the solar radiation. Accurate wavenumbers and Einstein's A coefficients of transitions were taken from the HITRAN-2004 database and the recent computation of water hot-band emission lines (Barber et al. 2006, MNRAS, 368, 1087). Assuming steady-state for each level, we can get population distribution of water from the ground state to highly excited vibrational states. We will present some comparisons between observations and calculations to demonstrate our model calculations.