

Fluorescence Processes of C₂H₆ in Hale-Bopp

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We developed line-by-line and time-dependent fluorescence model of the ν_7 band of C₂H₆, of which sub-branches had been detected in comets Hyakutake (C/1996 B2) (Mumma et al., 1996), and Hale-Bopp (C/1995 O1) (Weaver et al. 1998). We calculated fluorescence efficiency factors (*g*-factors) for the sub-branches of the ν_7 band as a function of cometocentric distance. We found that the *g*-factors of the sub-branches (ex. rQ_0 and rQ_1) near nucleus are greater than those far from the nucleus approximately a factor of two. Since the lifetime of C₂H₆ is long (~91,000 seconds at a heliocentric distance of 1 AU), C₂H₆ molecules far from the nucleus should be close to fluorescent equilibrium. We analyzed a ν_7 band spectrum of Hale-Bopp obtained at the IRTF with the CSHELL on March 2, 1997. Within a square aperture of 1" x 2" at a geocentric distance of 1.5 AU, we found that the most C₂H₆ molecules are not in the fluorescent equilibrium condition. We constructed synthetic spectra of the ν_7 band of C₂H₆ within the aperture in order to compare the model spectra with the observation. We discuss dominant processes of the fluorescence and implications of the fluorescence processes.

References

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