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Abundant CO_2 of comet C/2001 A2 (LINEAR) derived from a new evaluation method

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Forbidden oxygen lines observed in a visible spectrum of comet have been usually used to determine an amount of H_2O. The oxygen atoms in meta-stable states are considered to be generated by photo-dissociation reactions of parent molecules, not only H_2O but also CO and CO_2. However, when the comet is at around 1 AU from the Sun, it has been considered that only H_2O is a dominant source of the meta-stable oxygen atoms because the amount of CO_2 is less than that of H_2O. Cochran & Cochran (2001) reported the ratio of green to red doublet lines of the forbidden oxygen in C/1999 S4 (LINEAR) to be 0.06. Carbon bearing molecules such as CO and C_2 were depleted in this comet. Assuming that the result of Cochran & Cochran denotes the ratio of forbidden oxygen lines caused by H_2O only, the abundance ratio of CO_2/H_2O can be estimated from the green-to-red ratio of observed forbidden oxygen lines by using the excitation rate of CO_2 and H_2O of Festou & Feldman (1981). We derived the green-to-red ratio of forbidden oxygen lines from the high-dispersion spectroscopic data of four comets (116P/Wlid 4, C/1999 S4 (LINEAR), C/2001 A2 (LINAER), and C/2001 Q4 (NEAT)) that had been observed by the Subaru Telescope and HDS (High Dispersion Spectrograph). Interesting results were obtained for these comets. Especially, a large CO_2/H_2O ratio is obtained for C/2001 A2 (LINEAR), which showed several splitting and/or flare-up events around its perihelion passage. Abundant CO_2 might contribute to these splitting and/or flare-up events.

Keywords: Comets; Forbidden oxygen lines; CO_2

References

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