

A sensitive search for monodeuterio methane in comet by Keck-II/NIRSPEC

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Deuterium to Hydrogen (D/H) ratio of cometary molecules has been considered to be pristine and to hold the information about physical conditions in the solar nebula or in the natal molecular cloud where the molecules formed. To date, D/H ratios of water and hydrogen cyanide were measured in a few comets and the deuterium fractionation was found in both molecular species. The deuterium fractionation indicates the molecular formation under low temperature conditions. Here we report high-dispersion ($R=25000$) spectra of comet C/2004 Q2 (Machholz) in L-band. The observations were carried out by the Keck-II/NIRSPEC at Mauna Kea, Hawaii. Many molecular emission lines were recorded on a detector chip simultaneously. The spectra showed prominent emission lines of ν_3 vibrational band of CH_4 (R_0 and R_1) as well as a weak emission line that could be attributed to the transition of ν_4 vibrational band of CH_3D ($^R R_3(3)$). Since the rotational temperature of cometary coma gas were obtained accurately from emission lines of HCN molecules, we could obtain the D/H ratio of methane in the comet. The obtained D/H ratio of methane was consistent with the molecular formation at the temperatures higher than 30 K.