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Sensitive Search for Monodeuterio Methane in Comet C/2004 Q2

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High dispersion spectroscopic observations of comet C/2004 Q2 in L-band were carried out by the Keck-II/NIRSPEC at Mauna Kea, Hawaii. Our scientific goal was to detect emission lines of monodeuterio methane (CH_3D) and to determine deuterium-to-hydrogen ratio in methane. Here we report a tentative detection of cometary CH_3D emission in the comet. Fundamental vibrational bands of CH_4 (nu_3) and CH_3D (nu_4) were observed simultaneously. Apparent emission lines of CH_4 and a weak CH_3D emission line were found in the observed spectrum. We discuss the formation conditions of cometary ices based on the deuterium-to-hydrogen (D/H) ratio of methane. Obtained D/H ratio of methane was consistent to temperature conditions indicated by the D/H ratios of water and hydrogen cyanide observed in previous comets.