ROTATIONAL TEMPERATURE OF METHANE IN SUPERSONIC MOLECULAR BEAM

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Rotational temperature of methane in supersonic molecular beam was claimed to be about $10 \sim 40$ K in various conditions. It was found that distribution of the three nuclear spin modifications do not change during the supersonic cooling. A strong deviation from thermal equillibrium was also observed. We re-investigated the rotational temperature of methane by the rovibrational transitions of the ν_3 vibrational band. An infrared spectrometer with cw-OPO laser was used for the observation. The rotational temperature of CH_4 derived from transitions up to $J = 2$ was 10 K, consistent with the rotational temperature derived for the OCS molecule. Much higher rotational temperature ($\sim$ 70 K) with large diversity was obtained for higher J transitions of CH_4, which could be attributed to the incomplete relaxation of rotational-level distribution of light molecule as CH_4, a similar situation as the vibrational-level distribution in supersonic molecular beam.