SUBMILLIMETER-WAVE INVESTIGATION INTO THE BRANCHING RATIO OF DISSOCIATIVE RECOMBINATION REACTION OF $DCND^+$ WITH ELECTRONS

T. AMANO AND R. TOYODA, *Institute for Astrophysics and Planetary Sciences, Ibaraki University, Mito, Japan 310-8512*.

We found that, by examining the relative intensity of HCN and HNC produced in an extended negative glow discharge through a gas mixture of CH_4(2 mTorr) and N_2(16 mTorr), direct information on the branching ratio of dissociative recombination reaction of $HCNH^+$ with electrons could be derived. At liquid nitrogen temperature, the ratio [HCN]/[HNC] was found to be $\sim$3.5. The ratio is larger compared with a value obtained from *ab initio* calculation, and there is a possibility of isomerization from HNC to HCN, resulting in larger abundance of HCN. In the present investigation, we observed DCN and DNC in an extended negative glow discharge by replacing CH_4 with CD_4 at liquid nitrogen temperature. The ratio [DCN]/[DNC] was found to be $\sim$1.5. This result suggests that [HCN]/[HNC] obtained by this method may be suffered from the effect of isomerization.

Also striking isotope effect was observed on the vibrational temperature. The vibrational temperature for the ν_3 mode for DNC is as high as 4000K and the submillimeter lines are observable in the states up to (008), while it is 1500K for HNC. The vibrational temperature for the ν_1 mode is about 1000 K for DNC and about 1300 K for HNC. At the present stage, this conspicuous isotope effect is quite puzzling. However, it should be closely related to mechanism of the dissociative recombination.