Comparing Cloud Properties from Chemical Compositions of Cores

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The chemical characteristics within dense cloud cores can reveal their evolution stage. Because they have different production chemistries, the column densities of NH_3, CCS can reveal the chemical characteristics in dense cores. So, N(CCS)/N(NH_3) is a good indicator of chemical evolution [1].
We observed CCS $J_N=2_1$-1_0, NH_3 (J, K) = (1, 1), (2, 2) lines toward molecular cores in the Taurus Cloud Complex with the Hokkaido University Tomakomai 11 m Telescope.
Assuming LTE and T_k=10 K, we estimated column densities from our results. Figure 1 is a distribution of column densities of CCS and NH_3. Comparing this result with results of other clouds (e.g. the Perseus Cloud Complex [2], the Pipe Nebula [3]), we can compare properties of these clouds from chemical compositions of cores. For example, from low column density of NH_3 in cores, the Pipe Nebula seems to be younger than the Taurus Cloud Complex.
Additionally, we found that N(CCS)/N(NH_3(1, 1)) of our samples are lower in higher n(H_2) from $H^{13}CO^+$ J=1-0 line observation [4]. So, we can say chemical evolution of cores is consistent with physical evolution of cores.

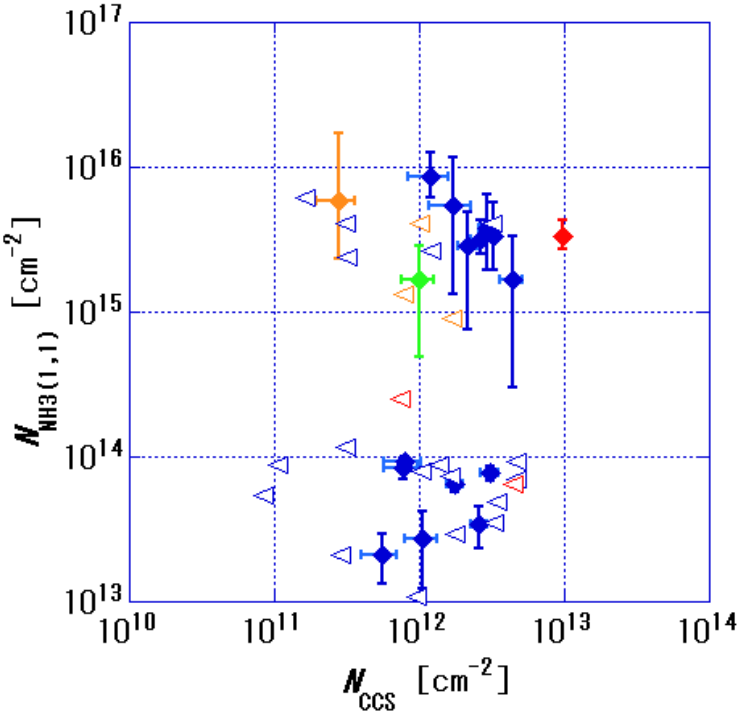

Figure 1: N(CCS) and N(NH_3(1, 1)) of Cores. Blue symbols show starless cores, orange and red symbols show cores with stars, a green symbol shows an accreting core. Open triangles show upper limit of N(CCS).

References

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