Nitrogen isotopic fractionation on Titan atmosphere: An analysis of ALMA archive data

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Observing isotopic fractionations of atmospheric molecules provides an important quantity to constrain physical and/or chemical processes that occur in the planetary atmosphere. Titan has a thick atmosphere mainly composed of nitrogen (N_2). It also contains many nitrogen-bearing compounds such as hydrogen cyanide (HCN), acetonitrile (CH_3CN), and cyanoacetylen (HC_3N), indicating the presence of a complex atmospheric chemistry among these nitriles. It is known that some of these nitriles have an isotopic fractionation that differs from the terrestrial values; for example, $^{14}N/^{15}N$ of HCN is 60 - 70 in Titan atmosphere whereas it is ~272 in the terrestrial atmosphere. Obtaining the $^{14}N/^{15}N$ values on other nitriles will help us to understand what is happening in Titan atmosphere.

Titan has been used as one of calibrator sources of ALMA observations, and therefore, not a few (> 900) data are stored in the ALMA archive. We surveyed all the Titan data in the ALMA archive, and extracted some data which were taken with sufficiently high spatial and spectral resolutions that can be endurable for scientific analyses. After careful investigation on the extracted data, we found one data set which contain the emission lines of the rotational transitions of $CH_3C^{14}N$ and $CH_3C^{15}N$.

By performing an inversion analysis using a radiative transfer model, we derived the nitrogen isotopic ratio on acetonitrile for the first time. Detail of the analysis will be presented in the meeting.

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