ALMA Unbiased Spectral Line Survey of an Organic-poor High-mass Protostar in the Large Magellanic Cloud

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Because cosmic metallicity is increasing in time with the evolution of the Universe, understanding interstellar chemistry in low metallicity environments is crucial to unveil chemical processes in past metal-poor galaxies and the early Milky Way Galaxy.

We here present a high-sensitivity spectral line survey towards a high-mass protostellar object located in a nearby low-metallicity galaxy, the Large Magellanic Cloud (LMC). The survey was conducted by the Atacama Large Millimeter/submillimeter Array (ALMA). The frequency coverage of the survey is from 333 to 364 GHz and the spatial resolution is about 0.4 arcseconds, which corresponds to 0.1 pc at the distance of the LMC. The target source, ST11, is reported to harbor a hot molecular core [1].

As a result of the spectral line survey, we have obtained a high-quality wide-band submillimeter spectral and continuum data for this low-metallicity high-mass protostar. Its physical and chemical characterstics are investigated in detail using the detected various molecular lines. The high gas density (>10^6), high temperature (>100 K), and small source size (<0.1 pc) observed in ST11 suggest that its physical characteristics are consistent with those of known normal-metallicity hot cores in the inner Galaxy. However, unlike typical hot cores, the source does not show any emission line of complex organic molecules such as CH3OH even after the stacking analysis of multiple lines. Only small organic molecules such as H2CO are detected. On ther other hand, inorganic molecules such as SO and SO2 are abundantly detected in the source. Several hydrogen recombination lines are also detected.

In this poster, we present the results of the initial analysis of the spectral line survey, and discuss the nature of this organic-poor high-mass protostar.

References

[1] T. Shimonishi, T. Onaka, A. Kawamura, & Y. Aikawa, 2016, ApJ 827, 72.