Widespread complex organic molecules in the Galactic center

With the support by the Major Program of the National Natural Science Foundation of China, a research group led by Prof. Shen Zhiqiang (**沈志强**) from Shanghai Astronomical Observatory, Chinese Academy of Sciences reports the detection of widespread CH_2OHCHO (glycolaldehyde) and $HOCH_2CH_2OH$ (ethylene glycol) emission in Galactic center giant molecular cloud Sagittarius B2, which strongly supports the existence of abundant prebiotic molecules in ices. This work was recently published in *The Astrophysical Journal* (2017, 849(115): 1—9).

COMs are thought to be directly related to the origin of life on the Earth; thus understanding the property and formation mechanism of these prebiotic molecules is a key for astrobiology. Observations indicate that COMs are abundant in Sagittarius B2 (Sgr B2). Most COMs, including glycolaldehyde and ethylene glycol, were first detected in Sgr B2. Glycolaldehyde, the simplest sugar-related molecule, can react with propenal to form ribose, a central constituent of RNA (Ribonucleic Acid). Ethylene glycol is a dialcohol, commonly known as an antifreeze coolant for car engines. However, the exact extent of glycolaldehyde and ethylene glycol in the Galactic center still remains unclear.

Their group carried out mapping observations of glycolaldehyde and ethylene glycol in Sgr B2 with the newly built Shanghai 65m TianMa Radio Telescope (TMRT). As a result, the spatial distribution of these two molecules (Figure) is found to be quite extended for the first time, with an over 15 arcmin angular size, corresponding to a linear size of approximately 100 light-years. The mass of glycolaldehyde is estimated to be about 10,000 times of Earth's mass, strongly indicating the presence of abundant COMs in the Galactic center.

The distribution of the two molecules is found to be not only around hot cores with active star-formation activity, but also in quiescent regions with less star-formation activity. Furthermore, the abundance of these two molecules decreases from the cold outer regions to the central star-forming regions. When combined with theoretical and experimental chemistry studies, these results suggest that the two molecules likely form through hydrogen reaction of CO on ice surface under a low-temperature.

The TMRT findings raise a question to us: are COMs abundant in the interstellar surface? If so, these molecules could be transferred to planets, and then provide abundant materials for the origin of life. Future infrared telescopes like James Webb Space Telescope could help answer these questions through more sensitive observations of ice constitutes.

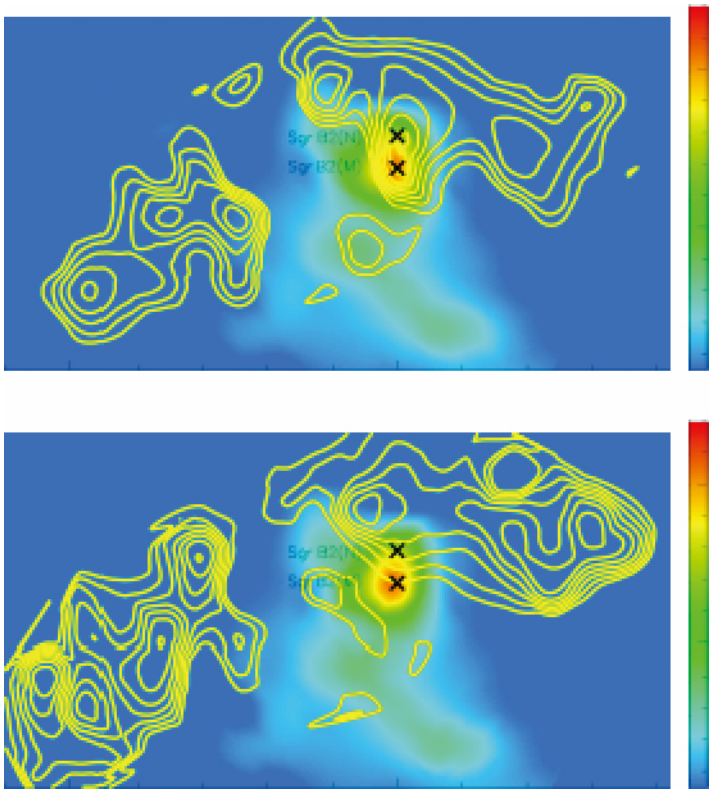

Figure Integrated intensity map of glycolaldehyde (upper panel) and ethylene glycol (lower panel) emission observed toward Sgr B2 overlaid on H78α emission in color scale.