LABORATORY INVESTIGATIONS OF AMINOMETHANOL FORMATION IN INTERSTELLAR ICES

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The formation of aminomethanol ($HOCH_2NH_2$), the predicted interstellar precursor to the simplest amino acid, glycine, is a fundamentally important process in prebiotic chemistry in the interstellar medium. A few studies have produced aminomethanol in mixed ices; Singh et al. were able to form aminomethanol in ices composed of methylamine and ozone, while Bossa et al. made aminomethanol in mixed ices made of formaldehyde (H_2CO), ammonia (NH_3), and water (H_2O) [a] [b]. However, aminomethanol has not yet been produced from ices with compositions that are realistic analogs of the simple composition of interstellar ices. We are therefore undertaking investigations of interstellar ice analogs composed of H_2O, NH_3, and CO in order to study this process. The SubLIME experiment will be utilized to conduct these studies. In this experimental setup the ices are processed via UV photolysis or temperature programmed desorption. Infrared spectroscopy is used to monitor the ice composition and determine the relative molecular abundance in deposited ices. A quadrupole mass spectrometer (QMS) serves to monitor the thermally desorbed gas phase species. Additionally, a mm/submm spectrometer is used to detect the gas phase species of ices once they have desorbed. These investigations elucidate the formation of this important molecule within an ice. Furthermore, spectra obtained can be compared to observational data. Here we report on the experimental design and initial results from these investigations.

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[a] Singh, S. K.; Zhu, C.; La Jeunesse, J.; Fortenberry, R. C.; Kaiser, R. I. Nature Communications 2022, 13, 375.

[b] Bossa, J. B.; Theule, P.; Duvernay, F.; Chiavassa, T. The Astrophysical Journal 2009, 707, 1524–1532