THE ROTATIONAL SPECTRA OF THE INTERNAL ROTORS METHYL GLYCOLATE AND DIMETHYL CARBONATE, STRUCTURAL ISOMERS OF THE 3C SUGARS

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A suite of sugars and other polyhydroxylated compounds has been found in aqueous extracts of the Murchison meteorite matrix, leading to observational searches for sugar-related species. The simplest α-hydroxy aldehyde, glycolaldehyde (CH_2OHCHO), was detected toward the hot core Sagittarius B2(N-LMH), but at much lower abundance than its structural isomers acetic acid (CH_3COOH) and methyl formate (CH_3OCHO). Searches for the 3C aldose sugar, glyceraldehyde ($CH_2OHCHOHCHO$), were not successful, but the 3C ketose sugar, dihydroxyacetone ($CO(CH_2OH)_2$) was detected in this source. Ketoses are much more stable than their aldose structural isomers, and so these results indicate that the relative stability of structural isomers may play a large role in their formation and/or survivability in the interstellar medium.

Both dimethyl carbonate ($(CH_3O)_2CO$) and methyl glycolate (CH_3OCOCH_2OH) are more stable than their 3C sugar structural isomers and would likely be created by any chemical pathway leading to the sugars. These two species should therefore be present in large abundance in the Sgr B2(N-LMH) hot core source. The microwave spectrum of methyl glycolate is known. The FT-microwave spectrum of dimethyl carbonate and the direct absorption millimeter and submillimter spectra of both species have been obtained in our laboratory. Dimethyl carbonate is a symmetric double internal rotor while methyl glycolate is an asymmetric single internal rotor, and so the spectrum of methyl glycolate is much more complex. Dimethyl carbonate has a very small dipole moment ($\sim$ 0.1 D), and so its spectrum is quite weak, greatly limiting spectral assignment. The ground state spectral analyses of these species have been completed, however, and these results will be presented. Preliminary results of observational searches will also be presented.