UNDERSTANDING THE DISTRIBUTION AND FORMATION OF COMPLEX ORGANIC MATERIAL IN THE ATMOSPHERE OF COMETS. A. J. Remijan[1], S. N. Milam[2] and M. A. Cordiner[3], [1]National Radio Astronomy Observatory/Joint ALMA Observatory (aremijan@nrao.edu), [2]NASA Goddard Space Flight Center (stefanie.n.milam@nasa.gov), [3]NASA Goddard Space Flight Center (martin.cordiner@nasa.gov)

Introduction: The transport of water and other primary volatiles to the surface of early planetary systems is key to the understanding of the formation and evolution of life. The chemical and physical atmospheric conditions on newly forming planets are now known to hinder the organic chemistry necessary to develop and form more complex organic material. The supposition is that much of the organic material is already formed and processed in the presolar nebula and then captured into comets and asteroids. These bodies then transport this material to the newly forming planets. An outstanding question in this process is how cometary material is processed and whether the primary volatiles necessary to organic chemistry are products of sublimation directly from the comet nucleus or if further processing takes place in the cometary coma.

High spatial and spectral resolution observations of comets are necessary to investigate this question. A primary tool in the detection of molecular material in comets is high sensitivity radio array telescopes such as the Atacama Large Millimeter/submillimeter Array (ALMA). Given the large collecting area of 66 12-m individual array elements, the flexibility in observing configurations that can sample numerous spatial scales, and the wide bandwidth receivers and highly flexible correlator configurations, ALMA is revolutionizing the way radio array observations are taken toward comets. Array observations that used to take hours of observing time can now be completed in minutes covering more spectral bandwidth at higher sensitivity. This presentation will highlight the new observations of molecular material in cometary comae and illustrate how the imaging capabilities of radio interferometers like ALMA are providing the necessary insight into the formation, distribution and excitation of pre-biotic organic molecules in comets.