CARBON CHAINS, CARBON RING-CHAINS, AND EXOTIC SILICON-CARBON RINGS

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Significant advances have been made here and abroad in the laboratory detection of many postulated astronomical molecules during the past five years. In our laboratory alone, nearly 100 carbon chains, carbon ring-chains, and exotic silicon-carbon rings have been identified for the first time by the application of Fourier transform microwave spectroscopy to supersonic molecular beams. Almost all of these molecules are good candidates for detection in space, and about 10% of these have now been detected with large telescopes, including the largest astronomical chain, $HC_{11}N$, and the largest reactive ring, rhomboidal SiC_3; with powerful new radio facilities planned or under construction, it would be surprising if many more could not eventually be found. Our laboratory techniques have now advanced to the point that any polar molecule which can be detected in space can probably be detected with our present laboratory spectrometer, or with some reasonable refinement of it.

This talk will provide a broad overview of our recent work, illustrating with a few specific examples the power of our laboratory techniques, and how these techniques can be applied to challenging problems in astronomical spectroscopy. Many of the results are of general interest to the chemical physics community, providing new information on the molecular structure, chemical bonding, and isomeric distributions of carbon species in the rich transition region from linear chains to planar and cyclic rings. A summary of recent laser experiments to measure the optical spectra of many of our newly found chains and rings by cavity ringdown absorption spectroscopy and two-color resonant-enhanced multiphoton spectroscopy will also be given.