

SPECTROSCOPY OF METAL AND PHOSPHORUS BEARING MOLECULES: A WINDOW ON THE UNIVERSE

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Small molecules containing refractory elements such as metals and phosphorus hold important clues to understanding astrochemistry and the connection between gas-phase matter and solid-state constituents of the interstellar medium. They also are extremely relevant for the origin of life and the delivery of the biogenic elements to planet surfaces. Studies of these types of molecules in interstellar space have clearly been driven by laboratory spectroscopy. For almost three decades, the Ziurys lab has been conducting measurements of rotational spectra of highly reactive metal and phosphorus-bearing species, and subsequently searching for these molecules in the interstellar medium with radio telescopes. These studies have led to the interstellar detection of exotic metal-bearing radicals such as FeCN and VO, as well as new phosphorus compounds such as CCP and SiP. Critical to this endeavor has been the development of unusual synthetic methods to create these unstable molecules, and the challenge of unraveling spectra of states with high spin and orbital angular momenta. Molecules of recent interest include metal dicarbide species, for example, TiC₂. An overview of the laboratory spectroscopy work will be presented, and their implications in unraveling the chemistry between the stars.