

Introduction to Astrochemistry – Part I: From Laboratory Spectra to the Composition of the Interstellar Medium

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To date, about 290 different chemical species have been discovered in the Interstellar Medium. The list of molecules detected in Space contains simple species (such as diatomics and small hydrides), Complex Organic Molecules, and even Polycyclic Aromatic Hydrocarbons. These chemical species have been observed in different astronomical objects, ranging from cold molecular clouds to star-forming regions, protoplanetary disks, and circumstellar shells. Most of our knowledge of the ISM relies on the analysis of the spectra recorded by radiotelescopes, which collect the photons emitted by gaseous molecules as consequence of the transition between rotational energy levels. Because of the high selectivity of rotational spectroscopy, rotational spectra can be regarded as the fingerprints of molecules and are thus used to determine which species are present in a given astronomical objects as well as their abundance.

In this seminar, the approach used in the laboratory to investigate rotational spectra of molecules of astrochemical significance is described. Emphasis will be put on the different type of instruments employed in the field as well as on the production of unstable species. Some theoretical aspects are also discussed. Finally, the methodologies used for detecting new molecules in the ISM and for the determination of their abundances are described.

