Colloquium

SFB 956

Conditions and Impact of Star Formation

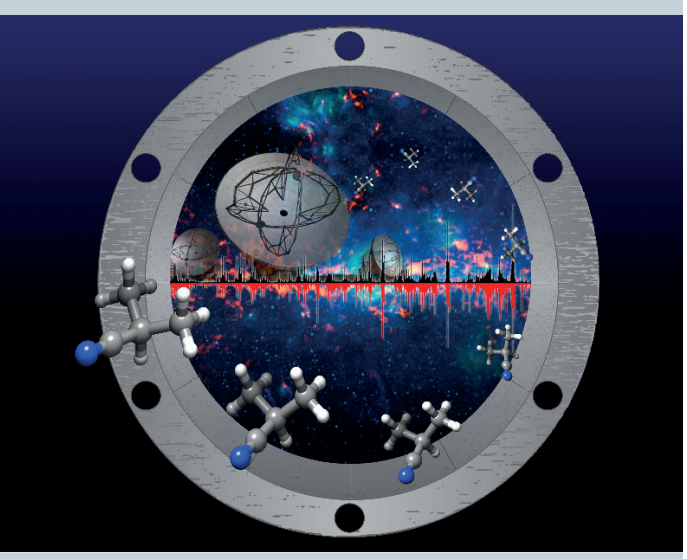
08.01.2018

Monday 3:00 pm

Max-Planck-Institut für Radioastronomie

Auditorium 0.02

Auf dem Hügel 69 | 53121 Bonn



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Unraveling Interstellar Chemistry with Broadband Microwave Spectroscopy and Free-electron Lasers

In the interstellar medium (ISM), chemical reactions are taking place in both the gas phase and on grain surfaces, which build up the complexity of organic molecules.
We provide high-resolution laboratory data, obtained with broadband chirped-pulse rotational spectroscopy and various advanced light sources, such as Free-Electron Lasers (FELs) and synchrotrons, to improve the knowledge of the chemical inventory of the ISM and potential chemical mechanisms. We are particularly interested in polycyclic aromatic hydrocarbons (PAHs) and molecules in vibrationally excited states.
While it is postulated that PAHs are at the basis of a rich chemistry, there has been no direct detection of individual types of PAHs in astronomical environments. We use a multi-spectroscopic approach to investigate PAHs and their chemistry. We employ broadband rotational spectroscopy to determine their structures and to investigate the hydration of PAHs to set a foundation for the future exploration of potential ice formation pathways. Far-IR spectroscopy allows us to study the global vibrations at low energies and the effect of anharmonicity. X-ray spectroscopy and VUV-UV and VUV-IR pump-probe spectroscopy provides insight into potential mechanisms for the interplay between ionization and fragmentation when interacting with harsh radiation.
Molecules in vibrationally excited states are interesting from a spectroscopic point of view and can provide information about the physical conditions of their environment. For this, we use a segmented W-band spectrometer (75–110 GHz), which provides direct overlap with ALMA band 3, and perform the experiments under room-temperature conditions (as shown in the example for i-propyl cyanide below). This approach thus provides access to high-resolution, pure rotational data of vibrational modes that occur in the far-infrared fingerprint region and that can be difficult to access with other techniques.