LABORATORY SPECTROSCOPY OF INTERSTELLAR RELEVANT MOLECULES

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Ever since the first detection of atomic and molecular spectral line features in space, secure identifications and proper kinematical analysis have been greatly dependent on the knowledge of accurate laboratory frequencies. So far, approximately 130 molecular carriers have been undoubtedly identified. Traditionally, laboratory spectroscopy and radio astronomy are concerned with the frequency regime up to approximately 300 GHz corresponding to a wavelength of 1 mm. However, sophisticated techniques have been developed in the last decades to make the submillimeter-wave range accessible routinely both for laboratory spectroscopy and radio astronomy.
In the Cologne laboratories, these techniques are primarily based on high-frequency backward wave oscillators (BWOs), on the multiplication of lower frequency Gunn diodes and BWOs, or on mixing millimeter wave radiation with a THz laser beam to make use of the resulting sideband radiation. Employing these techniques, spectroscopic investigations can be carried out in the entire frequency regime up to approximately 2.1 THz ($70\,\mathrm{cm}^{-1}$) covering the fields of pure rotational spectroscopy and rotation-vibration spectroscopy of low-energy vibrational modes.
Using these techniques a number of interstellar relevant molecules, including light hydrides, carbon chain molecules, radicals and ions have been characterized and data of high frequency accuracy have been obtained. Latest results will be presented in this talk.