LABORATORY HETERODYNE SPECTROMETERS OPERATING AT 100 AND 300 GHZ

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Two new laboratory heterodyne emission spectrometers are presented that are currently used for high-resolution rotational spectroscopy of complex organic molecules. The room temperature heterodyne receiver operating between 80-110 GHz, as well as the SIS heterodyne receiver operating between 270-370 GHz allow access to two very important frequency regimes, coinciding with Bands 3 and 7 of the ALMA (Atacama Large Millimeter Array) telescope. Taking advantage of recent progresses in the field of mm/submm technology, we build these two spectrometers using an XFFFTS (eXtended Fast Fourier Transform Spectrometer) for spectral acquisition. The instantaneous bandwidth is 2.5 GHz in a single sideband, spread over 32768 channels. Thus, the spectral resolution is about 76 kHz per channel and thus comparable to high resolution spectra from telescopes. Both receivers are operated in double sideband mode resulting in a total instantaneous bandwidth of 5 GHz. The system performances, in particular the noise temperatures and stabilities are presented. Proof-of-concept is demonstrated by showing spectra of methyl cyanide obtained with both spectrometers. While the transition frequencies for this molecule are very well known, intensities of those transitions can also be determined with high accuracy using our new instruments. This additional information shall be exploited in future measurements to improve spectral predictions for astronomical observations. Other future prospects concern the study of more complex organic species, such as ethyl cyanide. These aspects of the new instruments as well as limitations of the two distinct receivers will be discussed.