ROTATIONAL SPECTROSCOPY OF ^{13}C N-PROPYL CYANIDE USING A HOME-BUILT MM WAVE CHIRPED-PULSE SPECTROMETER WITH A NEW DIGITIZER

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So far, about 300 molecules have been found in the interstellar and circumstellar medium[1]. Among them is n-propyl cyanide, which was detected towards Sagittarius B2(N) in Atacama Large Millimeter/Submillimeter Array (ALMA) data[2,3]. Since the ratio of ^{12}C/^{13}C isotopologues is close to 25 for many molecules in Sagittarius B2(N)[4], it is reasonable to expect that its ^{13}C isotopologues can also be observed in this source.

We use an upgrade of our home-built mm wave chirped-pulse spectrometer in the range between 75-110 GHz[5] to measure spectra of the ^{13}C isotopologues of n-propyl cyanide for the first time. The isotopologues are present in the sample in natural abundance (ca. 1%). The detector of our spectrometer employs a heterodyne receiver which was originally built for the use in an emission spectrometer[6]. This device was not equipped for sideband separation. This makes it difficult to assign individual rotational transitions, as mirror lines are created, meaning artificial lines in the spectrum appear. Those features arising from intense lines are hard to distinguish from weak lines associated with the isotopologues. Therefore, we incorporated a new backend spectrometer into our setup, which consists of a home-built FPGA-ADC system, where we can record free induction decays for several different excitation phases in a cyclic manner to perform a sideband separation.

The new backend spectrometer in our mm wave chirped-pulse spectrometer is explained, its special features are discussed and spectra of n-propyl cyanide in natural abundance are presented which demonstrates the sensitivity of the improved instrument.

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