

First commissioning results of the new 32GHz FTS system at the 30m telescope

During several hours of technical time in July 2011, we tested and commissioned the new 32GHz system described in the News section of the Call for Proposals. A detailed commissioning report will be written in the coming weeks, but two very first results are shown in the following figures. To briefly summarize, commissioning went well, the new system works for the two resolutions of the new Fourier transform spectrometers (FTS), 200 and 50kHz, different band combinations of EMIR and for HERA, and for all observing modes including on-the-fly combined with frequency switching. Observers should be conscious that especially the latter mode easily creates huge amounts of data, up to 43 GB per hour. The switching between resolutions has to be done by the operator who will also take care that the FTS are not saturated.

Figure 1 shows a spectrum of the SiO maser line of the variable red giant star R Leo, observed switching the wobbler, comparing VESPA at 3kHz resolution with a spectrum taken with the FTS at 50kHz resolution exhibiting a perfect resemblance. Lines observed several GHz from the tuned rest frequency do however show frequency shifts of about 200kHz relative to their expected line position. New versions of the MIRA and CLASS software correct for these shifts. See also the dedicated report by Buchbender et al..

Figure 2 shows a frequency survey of the Galactic photon dominated region NGC7023 covering 33GHz of the 3mm window, also at a resolution of 50kHz using the 24 new FTS units connected to the EMIR E0 upper and lower sidebands of both polarisations. The data were taken in position switching mode during 6 hours of integration time. Platforming was corrected by subtracting 1st order baselines fitted to the spectra of the individual spectrometer units of 0.6 GHz width each in this case.

The positive spikes seen in Figure 2, are actually resolved lines. To give one example only, Figure 3 shows a portion of the 50kHz spectrum covering the HCN J=1-0 hyperfine structure lines.

NGC7023 is a prototypical PDR illuminated by a B2V star. The 30m data complement a frequency survey carried at submillimeter and far-infrared wavelength with HIFI/Herschel (C.Joblin, P.Pilleri, et al. 2010) in the framework of the WADI guaranteed-time key program led by V.Ossenkopf.

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1; 2 RLEO SiO(V1) 30ME0HLI-V01 O:13-JUL-2011 R:01-AUG-2011
RA: 09:47:33.46 DEC: 11:25:44.2 Eq 2000.0 Offs: +0.0 +0.0
Unknown tau: 0.044 Tsys: 86. Time: 1.5 min El: 60.4
N: 8139 l0: 4030.04 V0: 3.000 Dv: -1.1316E-02 LSR
F0: 86243.3500 Df: 3.2552E-03 Fi: 98742.2248

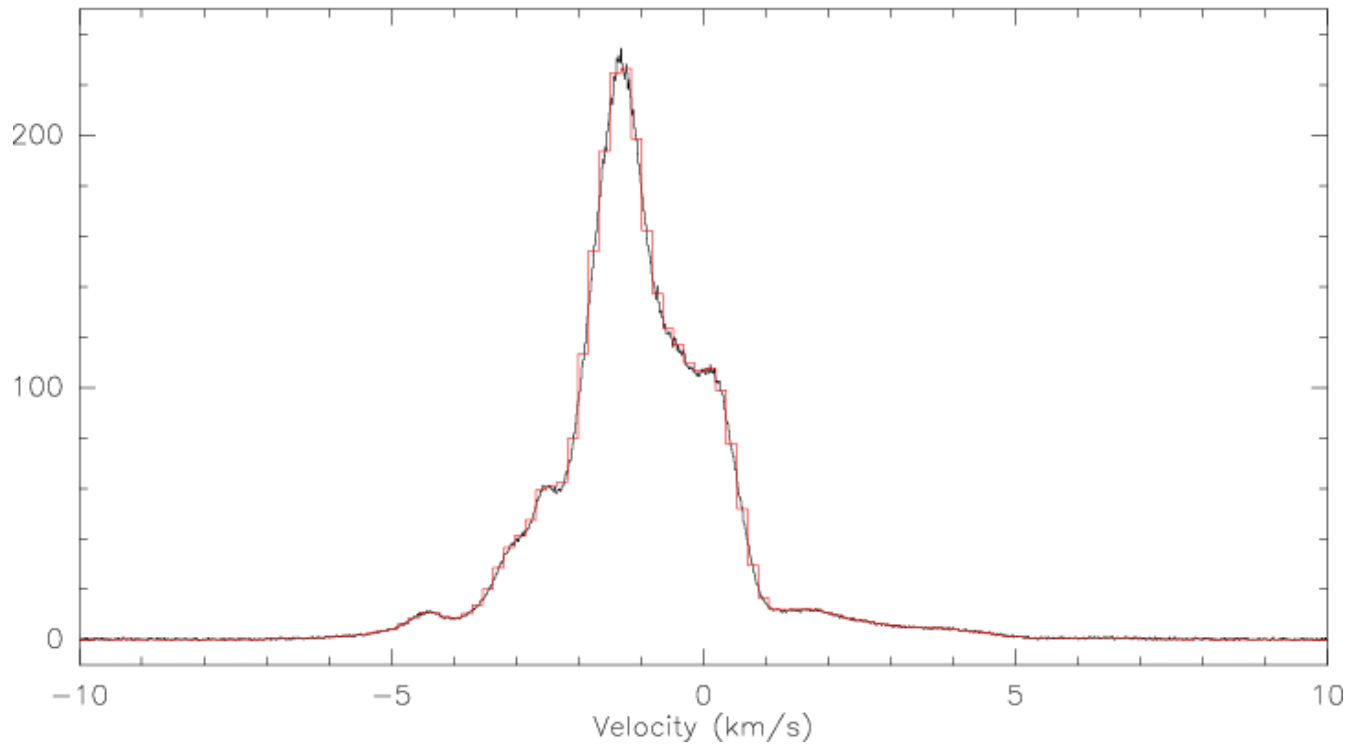


Figure 1 The SiO line of Rleo at 50kHz of the FTS and at 3kHz resolution with the VESPA backend.

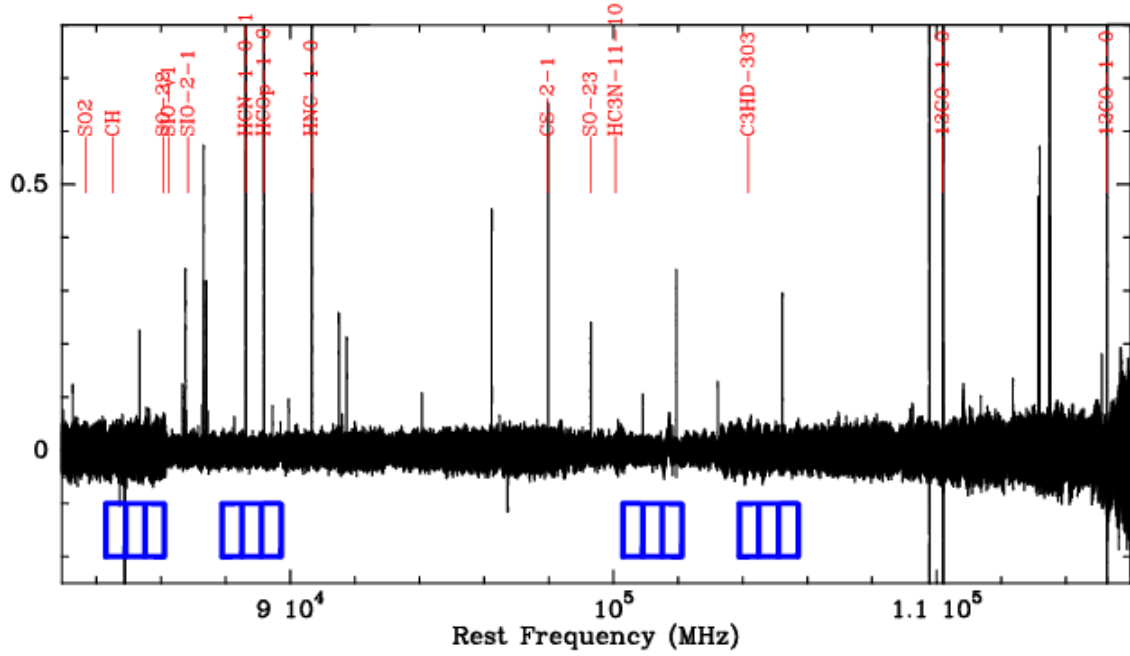


Figure 2: Frequency survey of NGC7023 covering 86 to 116 GHz at 50kHz resolution. The resulting spectrum consists of 740.149 channels. The contribution of the (varying) atmosphere to the noise can clearly be seen, especially at the high frequency end of the spectrum near the atmospheric oxygen line at 118 GHz. The blue boxes below the baseline show one of the frequency setups of the 50kHz FTS units. The four boxes mark the lower outer, lower inner, upper inner, and upper outer bands of E090. Each of the bands has a total bandwidth of 1.82GHz covered by 3 FTS units. The full spectrum was created by changing the rest frequency in steps of 1.8GHz.

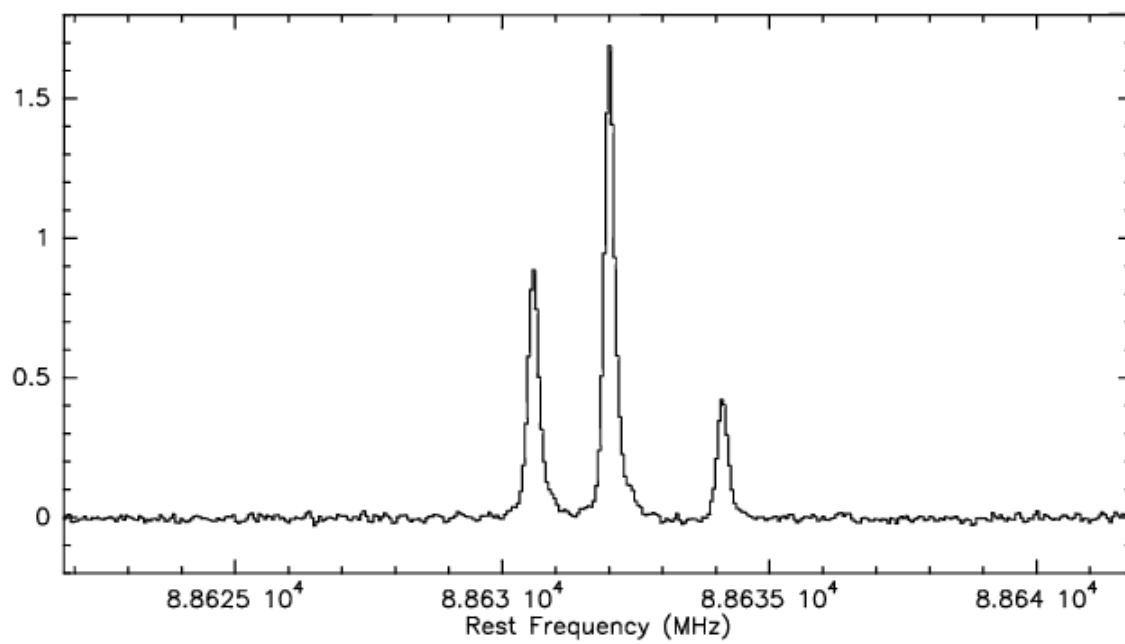


Figure 3 A part of the frequency survey of Figure 1, showing the HCN hyperfine structure components in NGC7023 at 50kHz resolution.