

# Spurious lines from mixing with higher harmonics of the local oscillator fundamental frequency in E230

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In observations during technical time in November 2016, EMIR spectra on IRC+10216 obtained with a tuning of 230.5 UI and local oscillator frequency of  $\nu_{LO}=224.251$  GHz, showed two lines slightly too broad for the line width of this source at 228.511 and 228.477 GHz. From their shape, distance and relative intensity they compare best to HCN( $J=3-2$ ,  $v_2=0$  & 1) at 265.886 and 265.853 GHz. The intermediate frequency of the stronger spurious component,  $\nu_{IF}=4.26$  GHz, indicates that the astronomical line is mixed with a frequency of 261.626 GHz, equaling the 7th harmonic of the fundamental Gunn oscillator frequency:  $\nu_{fund}=\frac{224.251}{6}$  (since E230 employs the third harmonic of  $\nu_{fund}$  multiplied by two, see report on EMIR ghost lines August 2014), analogue to cases of mixing with unwanted higher harmonics in E090 and E150 in the past. Another line with particular profile at 234.867 GHz, with  $T_A^* \sim 0.6$  K, can also be explained as originating from mixing of the 7th harmonic with a strong ( $\sim 18$  K) SiS line at 272.243 GHz. The ratio of integrated line intensities corresponds to an attenuation of  $-11$  to  $-14$  dB, comparable to the rejection of lines from the image sideband, and therefore potentially of concern for surveys on sources with strong lines.

These higher harmonics of the fundamental local oscillator frequency are currently not suppressed for E230. The installation of a filter, as has been done for bands E090 and E150 in the past, is planned.

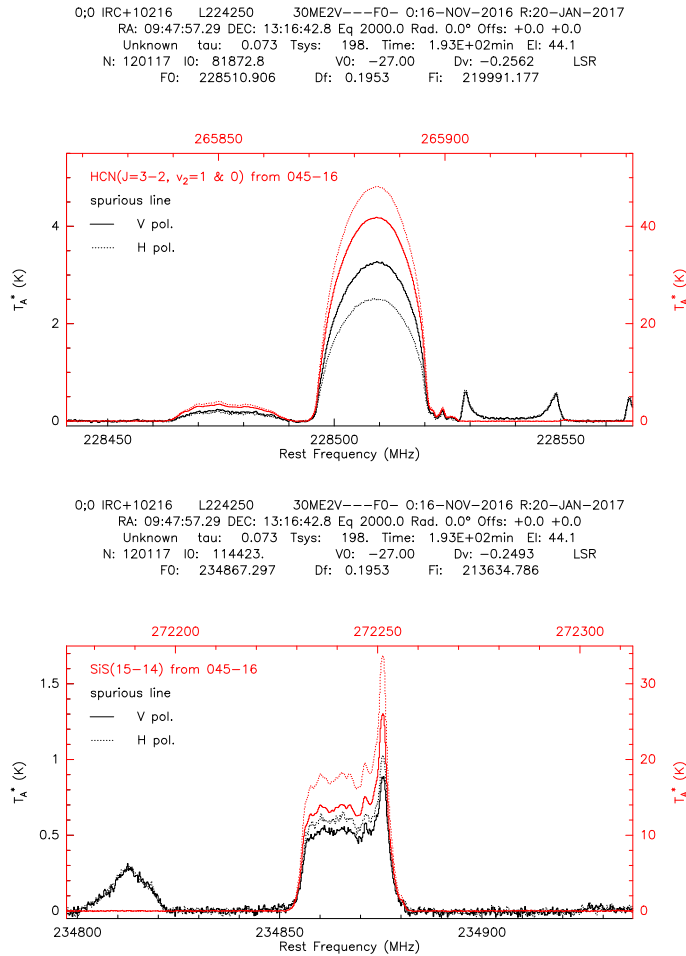


Figure 1: Examples of ghost lines in IRC+10216 originating from mixing of the 7th harmonic of the fundamental local oscillator frequency with HCN( $J=3-2$ ,  $v_2=1$  & 0) in the upper panel, and SiS(15-14) in the lower panel. The original astronomical lines are shown in red (courtesy of project 045-16, PIs: J. Cernicharo & J.R. Pardo), their ghost lines in black. Vertical and horizontal polarizations are indicated by solid and dotted lines, respectively.

## References:

Kramer, Navarrini, Navarro, John, Cernicharo; August 2014; IRAM Report on ghost lines.