The discovery of glycolaldehyde in a star forming region

Maria T. Beltràn[1], Claudio Codella[1], Serena Viti[2]
Roberto Neri[3] and Riccardo Cesaroni[1]

[1] Arcetri Observatory (Italy), [2] UCL (UK), [3] IRAM (France)

Abstract. Glycolaldehyde is the simplest of the monosaccharide sugars and is directly linked to the origins of life. We report on the detection of glycolaldehyde (CH_2OHCHO) towards the hot molecular core G31.41+0.31 through observations with the IRAM PdBI (Plateau de Bure Interferomter) at 1.4, 2.1, and 2.9 mm.

The CH_2OHCHO emission comes from the hottest ($\geqslant 300$ K) and densest ($\geqslant 2 \times 10^8$ cm^{-3}) region closest ($\leqslant 10^4$ AU) to the (proto)stars. The comparison of data with gas-grain chemical models of hot cores suggests for G31.41+0.31 an age of a few 10^5 yr. We have also shown that only small amounts of CO need to be processed on grains in order for existing hot core gas-grain chemical models to reproduce the observed column densities of glycolaldehyde, making surface reactions the most feasible route to its formation (Beltràn *et al.* 2009).

Figure 1 shows the brightness temperature scale of the CH_2OHCHO $(20_{2,18}\text{-}19_{3,17})$, $(14_{0,14}\text{-}13_{1,13})$, and $(10_{1,9}\text{-}9_{2,8})$ at 220463.87, 143640.94, and 103667.91 MHz, respectively, as observed towards the central position of the G31.41+0.31 hot core - see Beltràn *et al.* 2009 for details. Rest frequencies are pointed out by vertical bars.

- Upper panel: the glycolaldehyde line is blended with the CH3CN (12-11; K = 8) line. Two additional lines are present: (i) $^{13}CH_3CN$ $(12_6 - 11_6$; labeled by K'), and (ii) HCOOCH$_3$-A $(25_{11,15} - 26_{9,18})$ (2204445.79 MHz; Eu = 272 K) which could contain an emission contribution due to the CH_2OHCHO $(18_{4,14} - 17_{4,13})$ (220433.51 MHz; Eu = 108 K) line. The continuous line shows the fit to the group of three lines formed by the CH_2OHCHO $(20_{2,18} - 19_{3,17})$, CH$_3$CN (12-11; K = 8), and $^{13}CH_3CN$(12-11; K' = 6); the dotted lines draw the three individual Gaussian curves used for the fit.

- Middle panel: the CH_2OHCHO line is part of a spectral pattern containing also the HCCC^{13}CCN (143636.63 MHz; Eu = 183 K), C$_2$H$_3$CN $(33_{2,31} - 32_{4,28}$ (143646.50 MHz; Eu = 620 K), and C$_2$H$_5$OH $(29_{2,28} - 28_{3,26}$ (143651.78 MHz; Eu = 415 K) lines. The results of the fit as drawn as in the upper panel.

- Lower panel: besides the glycolaldehyde emission, an unidentified spectral pattern is present around 103674 MHz. The solid curve shows the fit of the isolated CH_2OHCHO line.

References

Beltràn, M., Codella, C., Viti, S., Neri, R., & Cesaroni, R. 2009, *ApJ* (Letters) 690, L93
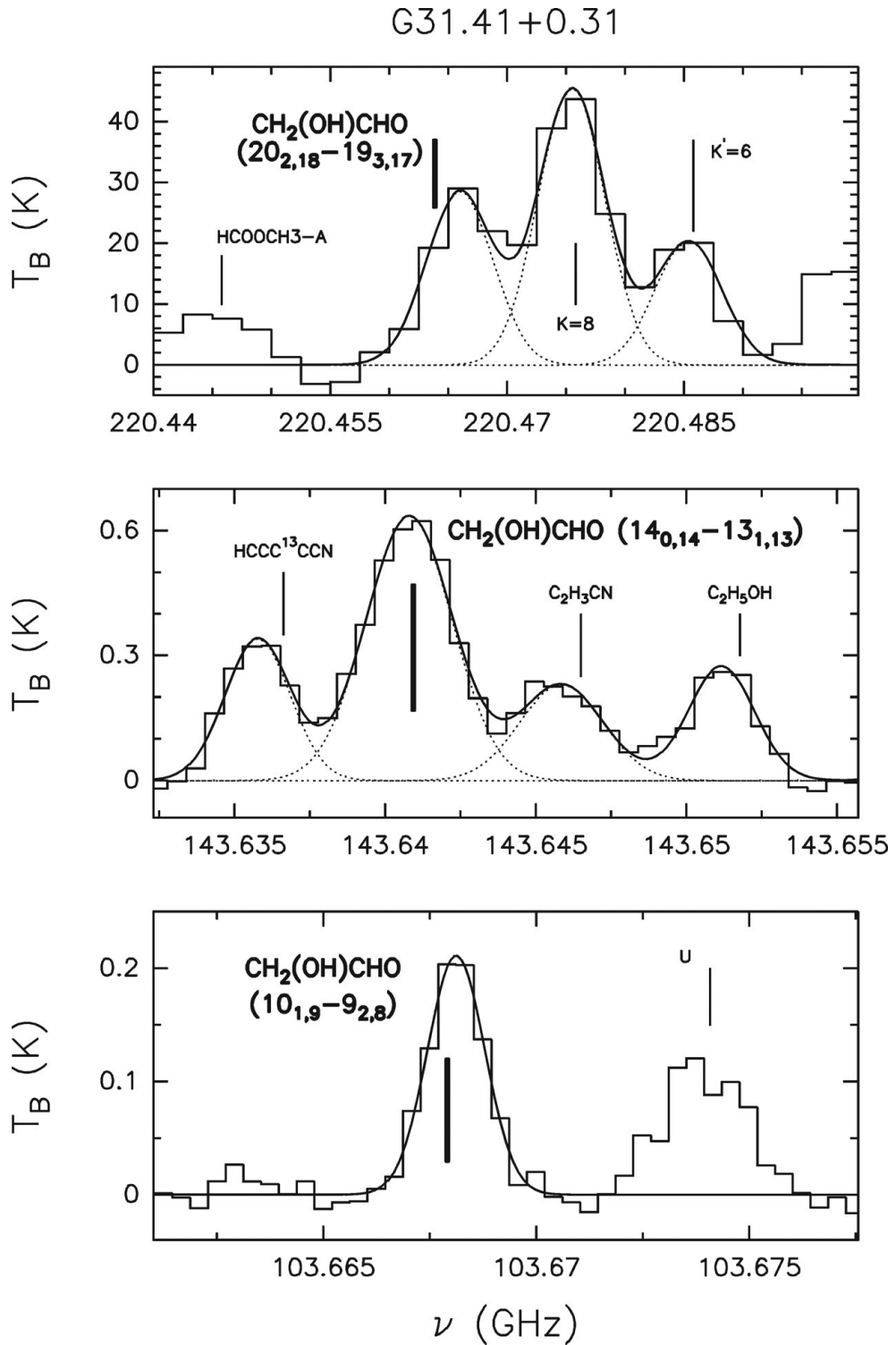
Figure 1. Beam-averaged spectra in the hot core of G31.41+0.31 (after Beltràn *et al.* 2009)