A SENSITIVE LINE SURVEY OF TMC-1: THE CHEMICAL COMPLEXITY OF A COLD DARK CLOUD

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We present a line survey of the cold dark core TMC-1 carried out with the YEBES 40m radio telescope in the Q-band. A new set of receivers have been installed in the telescope within the frame of the ERC synergy Nanocosmos project that allows to cover the whole 31-50 GHz band in dual polarization. The spectral resolution is 38.15 kHz. The sensitivity achieved so far varies between 0.3 and 1.5 mK, and allows to search for new molecules in a line by line (no stacking) detection procedure. These new data have permitted to detect the protonated species HC_5NH^+[a], HC_3O^+[b], HC_3S^+[c], and CH_3CO^+[d]. Each one of these species were detected first in TMC-1 by looking for unknown lines with harmonic frequency relations. All of them have been confirmed in the laboratory except HC_5NH^+, for which our identification is based in high-level of theory ab initio calculations.

Neutral molecules with low permanent dipole moment such as CH_2CHCCH[e], and $CH_2CCHCCH$[f] have been also detected with a very large abundance. In addition, nitrile anions such as C_3N^- and C_5N^- have been also detected confirming the previous assigment of C_5N^- reported in the carbon-rich star IRC+10216 (Cernicharo et al. 2008, ApJ, 688, L83).

[a] Marcelino et al. 2020, A.&A., 643, L6

[b] Cernicharo et al. 2020, A.&A., 642, L17

[c] Cernicharo et al. 2021, A.&A., 643, L3

[d] Cernicharo et al. 2021, A.&A., 646, L7

[e] Cernicharo et al. 2021, A.&A., in press; 2021arXiv210210920C

[f] Cernicharo et al., 2021, A.&A., in press