Organic Chemistry in C-rich Evolved Stars

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The search for simple organic molecules out of the Solar System has been hampered due to the lack of a permanent dipole moment displayed by many of them. These molecules do not show a pure rotational spectrum in the mm spectral range but their ro-vibrational spectra can be observed in the IR. Unfortunately, the atmosphere, which shows large amounts of H_2O and CO_2 in addition to traces of small organic species (e.g., C_2H_2, C_2H_4, and C_2H_6), blocks part of the extraterrestrial molecular radiation increasing the difficulty of the identification processes. Consequently, searching for new molecules in the IR commonly makes use of space observatories (ISO, Spitzer, JWST) despite their low availability. However, it is possible to use also ground-based facilities for this task along with high spectral resolution spectroscopy and taking advantage of a good telluric calibration, the transparent intervals existing between the telluric features, and the Doppler shift due to the Earth's orbital motion.

In this poster, we will present a brief summary of the detection attempts of simple non-polar organic molecules performed in evolved stars during the last decades and our last results achieved with ground-based facilities (IRTF/TEXES [1,2,3,4] and iSHELL, Fonfría et al., *in preparation*) and airborne observatories (SOFIA/EXES; Fonfría et al., *in preparation*).

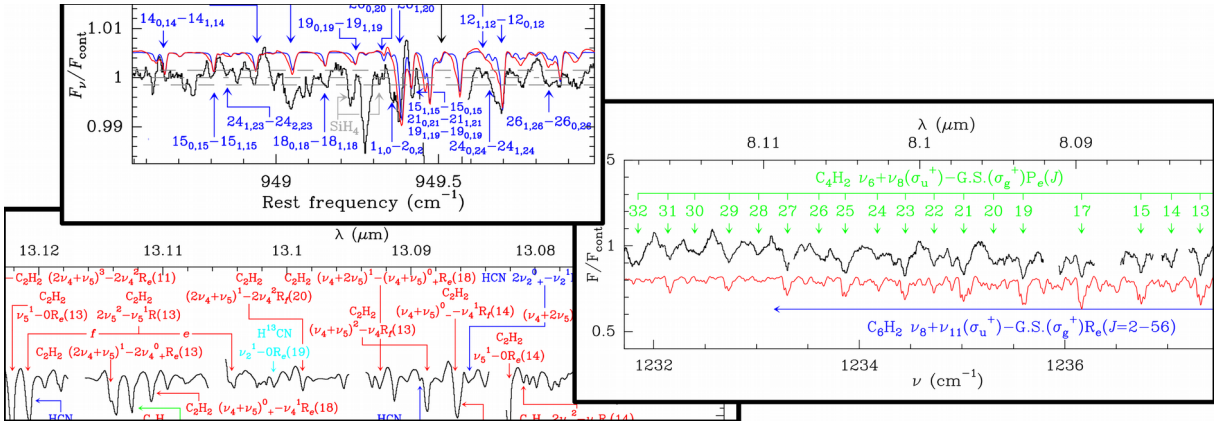

Figure 1: Examples of detection of C_2H_2 (lower left), C_4H_2 and C_6H_2 (right), and C_2H_4 (upper left) in the mid-infrared in evolved stars with IRTF/TEXES (IRC+10216 and CRL618 at left and right, respectively [1,2,3]).

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References

[1] Fonfría, Cernicharo, Richter & Lacy, 2008, *ApJ*, 673, 445
[2] Fonfría, Cernicharo, Richter & Lacy, 2011, *ApJ*, 728, 43
[3] Fonfría, Hinkle, Cernicharo, Richter & Wallace, 2017, *ApJ*, 835, 196
[4] Fonfría, Agúndez, Cernicharo, Richter & Lacy, 2018, *ApJ*, 852, 80