Why Galaxies Care About AGB Stars:
A Continuing Challenge through Cosmic Time
Proceedings IAU Symposium No. 343, 2019
F. Kerschbaum, M. Groenewegen & H. Olofsson, eds.

doi:10.1017/S174392131800755X

On the nature and mass loss of Bulge OH/IR stars

Joris A. D. L. Blommaert[1], Martin A. T. Groenewegen[2], Kay Justtanont[3] and L. Decin,[4]

[1]Astronomy and Astrophysics Research Group, Department of Physics and Astrophysics, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium

[2]Koninklijke Sterrenwacht van België, Ringlaan 3, 1180 Brussel, Belgium

[3]Chalmers University of Technology, Onsala Space Observatory, S-43992 Onsala, Sweden

[4]Instituut voor Sterrenkunde, K.U. Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium

Abstract. We report on the successful search for CO (2-1) and (3-2) emission associated with OH/IR stars in the Galactic Bulge. We observed a sample of eight extremely red AGB stars with the APEX telescope and detected seven. The sources were selected at sufficient high Galactic latitude to avoid interference by interstellar CO, which hampered previous studies of inner galaxy stars. We also collected photometric data and Spitzer IRS spectroscopy to construct the SEDs, which were analysed through radiative transfer modelling. We derived variability periods of our stars from the VVV and WISE surveys. Through dynamical modelling we then retrieve the total mass loss rates (MLR) and the gas-to-dust ratios. The luminosities range between approximately 4,000 and 5,500 $L_\odot$ and periods are below 700 days. The total MLR ranges between 10^{-5} and 10^{-4} $M_\odot$ yr^{-1}. The results are presented in Blommaert *et al.* 2018 and summarized below.

Keywords. Stars: AGB and post-AGB – Stars: mass-loss – circumstellar matter – dust – Galaxy: bulge – radio lines: stars

1. Introduction

Studying AGB stars in the Bulge gives the advantage of relatively well known distances (~ 8 kpc) and gives the opportunity to investigate not only the evolution on the Asymptotic Giant Branch but to shed light on Bulge stellar population and thus on the history of this central part of the Galaxy. So far, CO observations in this region had only limited success and concentrated on OH/IR stars near the Galactic centre. We selected a sample of stars at higher latitudes, ensuring their bulge membership and avoiding the strong interference from interstellar CO gas near the Galactic plane.

2. Results and conclusions

An example of the CO J= 2-1 and J= 3-2 transitions measurements with the APEX telescope is shown in Fig. 1.

On basis of our modelling of the observed SED and CO lines, we find that the stars have an average luminosity of $4729 \pm 521\,L_\odot$ and the average MLR is $(5.4 \pm 3.0)\ 10^{-5}\,M_\odot\,yr^{-1}$. Such MLR is well above the classical limit, with a single scattering event per photon, for the luminosities in our sample. The gas-to-dust ratios are between 100 and 400 and are similar to what is found for OH/IR stars in the Galactic disk.

The variability periods of our OH/IR stars are below 700 days and do not follow the Mira-OH/IR PL relation (Whitelock *et al.* 1991).

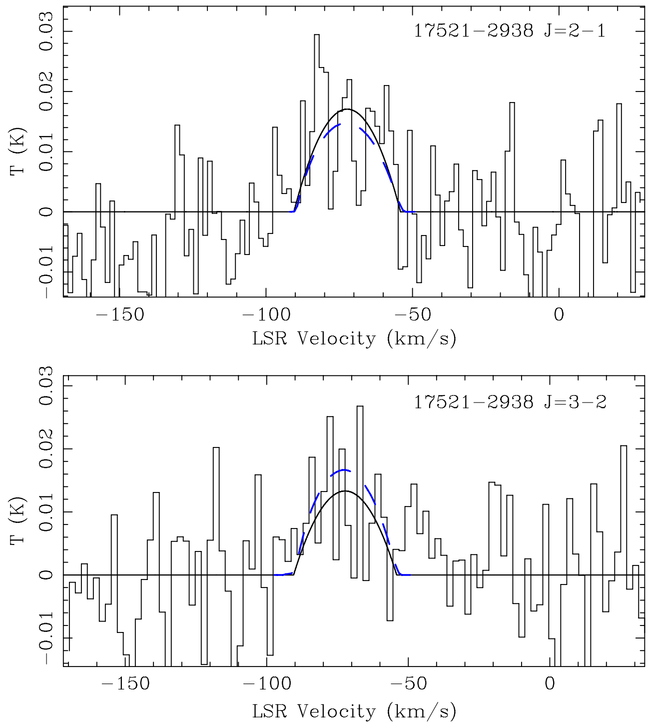

Figure 1. The APEX CO (2-1) and (3-2) line spectra, together with the line fits (in black) and the model predictions (dashed blue).

Comparison with the Vassiliadis & Wood (1993) evolutionary models shows that the progenitor mass of the bulge OH/IR stars is $\approx 1.5\,M_\odot$, similar to the bulge Miras and are of intermediate age (3 Gyr) (Groenewegen & Blommaert 2005). If more massive OH/IR stars are rare in the bulge this may explain the scarcity of bulge carbon stars.

Contrary to findings of bright OH/IR stars in the Galactic disk (Justtanont *et al.* 2013), our modeling does not impose a limit to the duration of the superwind below a thousand years.

One star, IRAS 17347-2319, has a very short period of approximately 300 days which may be decreasing further. It may belong to a class of Mira variables with a sudden change in period and may be connected to the occurance of a thermal pulse. It would be the first example of an OH/IR star in this class and deserves further follow-up observations.

References

Blommaert, J.A.D.L., Groenewegen, M.A.T., Justtanont, K., & Decin, L. 2018, *MNRAS*, 479, 3545

Groenewegen, M.A.T. & Blommaert, J.A.D.L. 2005, *A&A*, 443, 143

Justtanont, K., *et al.* 2013, *A&A*, 556, A101

Vassiliadis, E. & Wood, P. 1993, *ApJ*, 413, 641

Whitelock, P., Feast, M., Catchpole, R. 1991, *MNRAS*, 248, 276

https://doi.org/10.1017/S174392131800755X Published online by Cambridge University Press