Near Infrared Spectroscopy of red supergiants in NGC 6822, IC 10 & WLM with EMIR

E. Christodoulou[1,2] *, A.Z. Bonanos[1],G. Munoz-Sanchez[1,2],S. de Wit[1,2], G. Maravelias[1,3] and D. Garcia Alvarez[4]
[1]National Observatory of Athens, Greece, [2]National and Kapodistrian University of Athens, Greece, [3] Institute of Astrophysics, FORTH,Heraklion, Greece, [4] Instituto de Astrofisica de Canarias,Spain

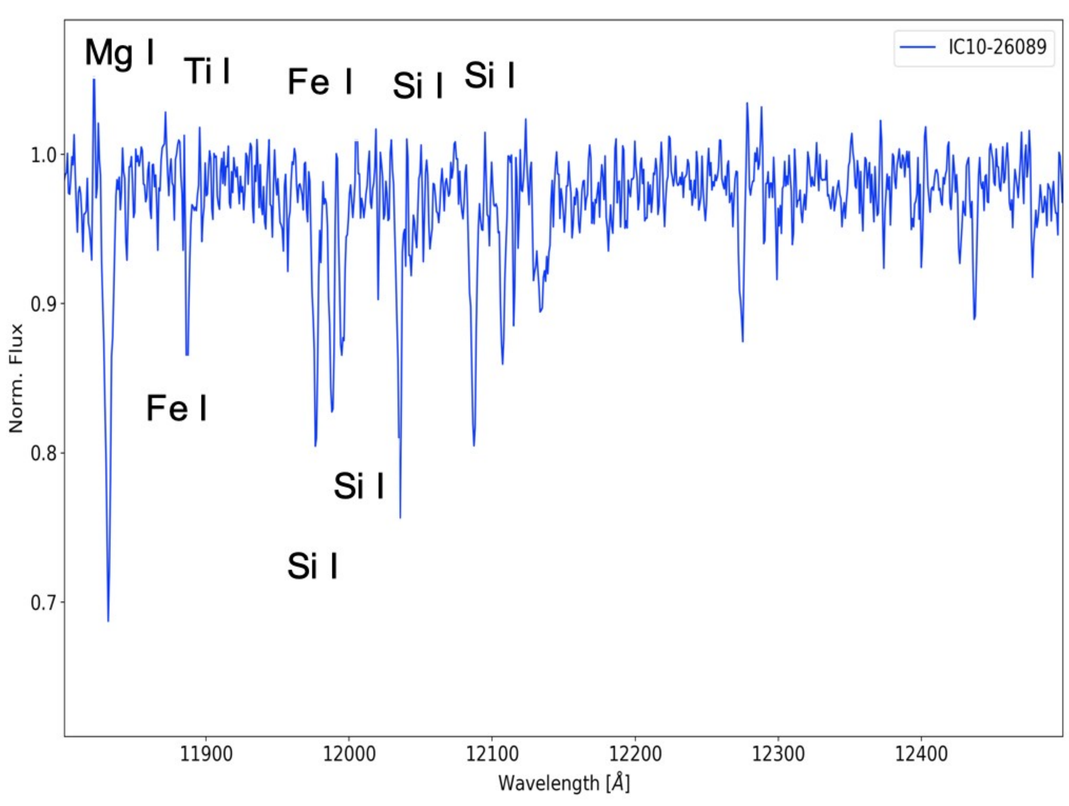
Abstract: The ERC funded ASSESS project aims to determine the role of episodic mass loss in the evolution of the most massive stars by conducting the first extensive, multi-wavelength survey of evolved massive stars in the nearby Universe. We have already analyzed the results of our survey in the northern hemisphere, leading to the secure classification of twelve RSG in NGC 6822 and IC 10. We have acquired follow up observations in the J band of eight of them using EMIR at GTC. Also, we observed one target from the literature (WLM 14). In this work we present our first results from the analysis of these observations.

Observations

The observations took place from September to December 2022 with EMIR at GTC using the J grism and J filter in long slit mode (PI: D. Garcia Alvarez). We split our targets in two groups based on their J magnitude, aiming to get spectra with a signal to noise ratio of around 100 and resolution of 5,000. High priority targets were IC_10-26089 and NGC_6822-103. Our target NGC_6822-55 was observed in IR and classified by Patrick et al. (2015) (their RSG11). We wanted to observe it to perform independent modelling for it and search for variability.The full list of our targets is given in Table 1. We used the EMIR dedicated pipeline for the reduction of the data and the MARTELL software (Rubio-Diez (2020), PhD thesis) for the telluric correction. For more information about EMIR see Garzon et al. (2022).

Preliminary Results

Figure 2: One example of our reduced spectra corrected for telluric lines. Characteristic spectral lines are indicated.
It is noted that the dominant spectral features are due to the metallic lines of Fe I Mg I, Si I and Ti I. The fluctuations in the continuum level are blends of molecular lines, which behave as a pseudo – continuum. These features can be modelled to derive the effective temperature.



Target selection

Figure 1: CMD of our targets using Spitzer photometry. It is evident that most of our targets show IR excess i.e. those with $m_{3.6} - m_{4.5} > 0.25$, indicating that they lose mass.

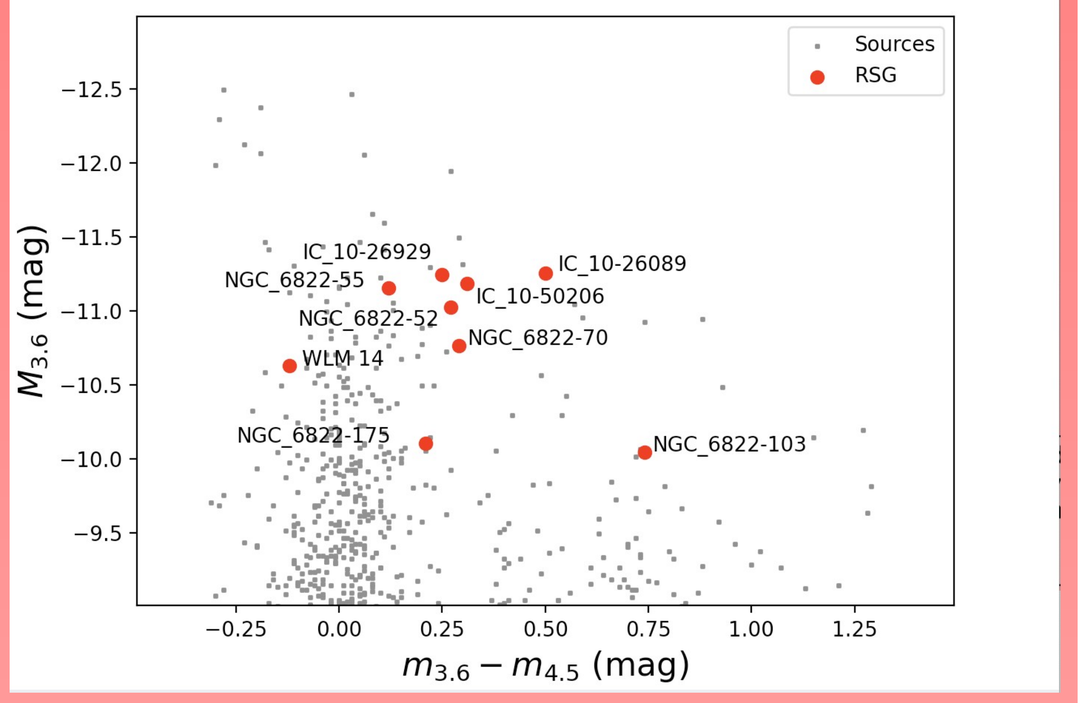


Table 1: Table containing the properties of our targets

Name	RA (^{h} ^{m} ^{s})	DEC ($^\circ$ $'$ $''$)	Mag.	Texp.
IC_10-26089	00 20 03.687	+59 18 13.91	J=15.5	3360 s
IC_10-50206	00 19 59.901	+59 19 43.71	J=15.7	3360 s
IC_10-26929	00 20 10.622	+59 20 53.10	J=15.8	3360 s
NGC_6822-103	19 44 46.666	-14 52 25.35	J=13.8	960 s
NGC_6822-55	19 44 56.616	-14 51 58.71	J=13.3	960 s
NGC_6822-52	19 44 51.856	-14 43 59.47	J=13.6	960 s
NGC_6822-70	19 44 55.558	-14 43 50.53	J=13.9	960 s
NGC_6822-175	19 44 55.412	-14 48 10.11	J=14.4	960 s
WLM 14	00 02 03.043	-15 30 34.20	J=15.3	3360 s

Goal

We aim to model our spectra using MARCS models both in the optical (using the TiO bands) and in the NIR (using the atomic lines in the J band). This way, we will get accurate effective temperatures in low metallicity regimes. We will determine all the physical parameters (e.g. luminosity, radius) of the sample of RSGs, measure the mass loss rates with DUSTY and finally, compare our results with evolutionary models to check if the targets can be reproduced on the Hertzsprung-Russel diagram.

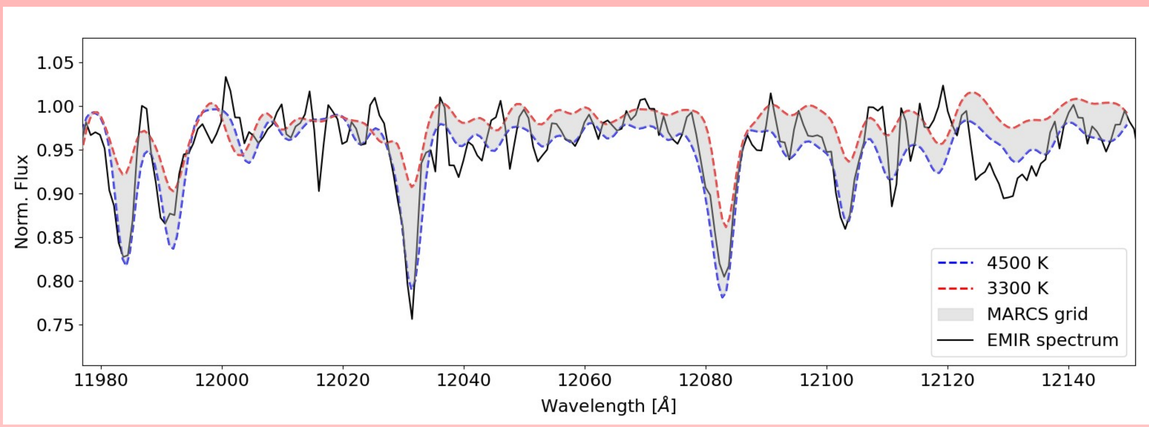


Figure 3: Same as figure 2 with a grid of MARCS models ranging from 3300 K to 4500 K plotted on top. It is obvious that the J band is sensitive to the effective temperature.

*Contact: evachris@noa.gr

What is next:
Modelling using MARCS models
Proposal to observe three more targets in Sextans A

References
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