*Massive Stars Near and Far*
*Proceedings IAU Symposium No. 361, 2024*
*J. Mackey, J. S. Vink, & N. St-Louis, eds.*
doi:10.1017/S1743921322003155

# ASSESSing evolved massive stars in NGC 6822 and IC 10

**G. Munoz-Sanchez[1,2], G. Maravelias[1,3], A. Z. Bonanos[1], F. Tramper[4], S. de Wit[1,2] and M. Yang[1,5]**

[1]IASSARS, National Observatory of Athens, Athens, Greece

[2]National and Kapodistrian University of Athens, Athens, Greece
email: gonzalom@noa.gr

[3]Institute of Astrophysics, FORTH, Heraklion, Greece

[4]Institute of Astronomy, KU Leuven, Belgium

[5]Key Laboratory of Space Astronomy and Technology, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, People's Republic of China

**Abstract.** The role of mass loss from massive stars, especially episodic mass loss, is one of the outstanding open questions facing stellar evolution theory. Multiple lines of evidence are pointing to violent, episodic mass-loss events being responsible for removing a large part of the massive stellar envelope, especially in low-metallicity galaxies. The ERC ASSESS project aims to determine whether episodic mass loss is a dominant process in the evolution of the most massive stars by conducting the first extensive, multi-wavelength survey of evolved massive stars in the nearby Universe. The project hinges on the fact that mass-losing stars form dust and are bright in the mid-infrared. We aim to investigate the properties of evolved targets in nearby galaxies and estimate the amount of ejected mass, which will constrain evolutionary models. In this work we present some of our first observational results from the galaxies NGC 6822 and IC 10 obtained with OSIRIS (GTC).

**Keywords.** stars: mass loss, stars: winds and outflows, circumstellar matter

## 1. Introduction

The episodic mAss loSS in Evolved maSsive Stars (ASSESS†) is one of the outstanding open questions facing stellar evolution theory. In this project we propose a study of nearby galaxies within a wide range of metallicities ($1/15 - 2\,Z_{\odot}$) to disentangle the effect of mass loss in massive stars by observing luminous-reddened objects.

We focus on reddened stars in the mid-infrared because it indicates the presence of dust in their surroundings. Specifically, we have used the 3.6$\mu$m and 4.5$\mu$m bands from Spitzer photometry to create a catalog of reddened stars in the galaxies selected. Given the amount of possible targets, we created a priority system of objects to observe (Table 1). VIS/NIR indicates whether photometry exists in the optical/near-infrared. The catalog was filtered with Gaia DR2 to discard contamination of foreground stars.

## 2. Observations

The observations of NGC 6822 and IC 10 took place on August 2020 with OSIRIS‡ (GTC) in the multi-slit mode using the grism 1000R, providing a spectral coverage between 5200-9200 Å and a 2.6 Å/px dispersion. We observed the galaxies with two and

† http://assess.astro.noa.gr/
‡ http://www.gtc.iac.es/instruments/osiris/

**Table 1.** Priority system of ASSESS. The number $x/y$ means $x$ objects detected in the observations out of $y$ objects selected.

| | **Prio 1** | **Prio 2** | **Prio 3** | **Prio 4** | **Prio 5** | **Prio 6** |
|---|---|---|---|---|---|---|
| $m_{3.6} - m_{4.5}$ (mag) | $\geq 0.5$ | $\geq 0.25$ | $\geq 0.5$ | $\geq 0.25$ | $\geq 0.1$ | $\geq 0.1$ |
| $M_{3.6}$ (mag) | $\leq -9.75$ | $\leq -9.75$ | $\leq -9.75$ | $\leq -9.75$ | $\leq 9.0$ | $\leq -9.0$ |
| VIS/NIR | Yes | Yes | No | No | Yes | No |
| NGC 6822 | 5/7 | 3/3 | 0/1 | – | 22/28 | 1/1 |
| IC 10 | 1/1 | 2/2 | 1/2 | – | 11/14 | 7/15 |

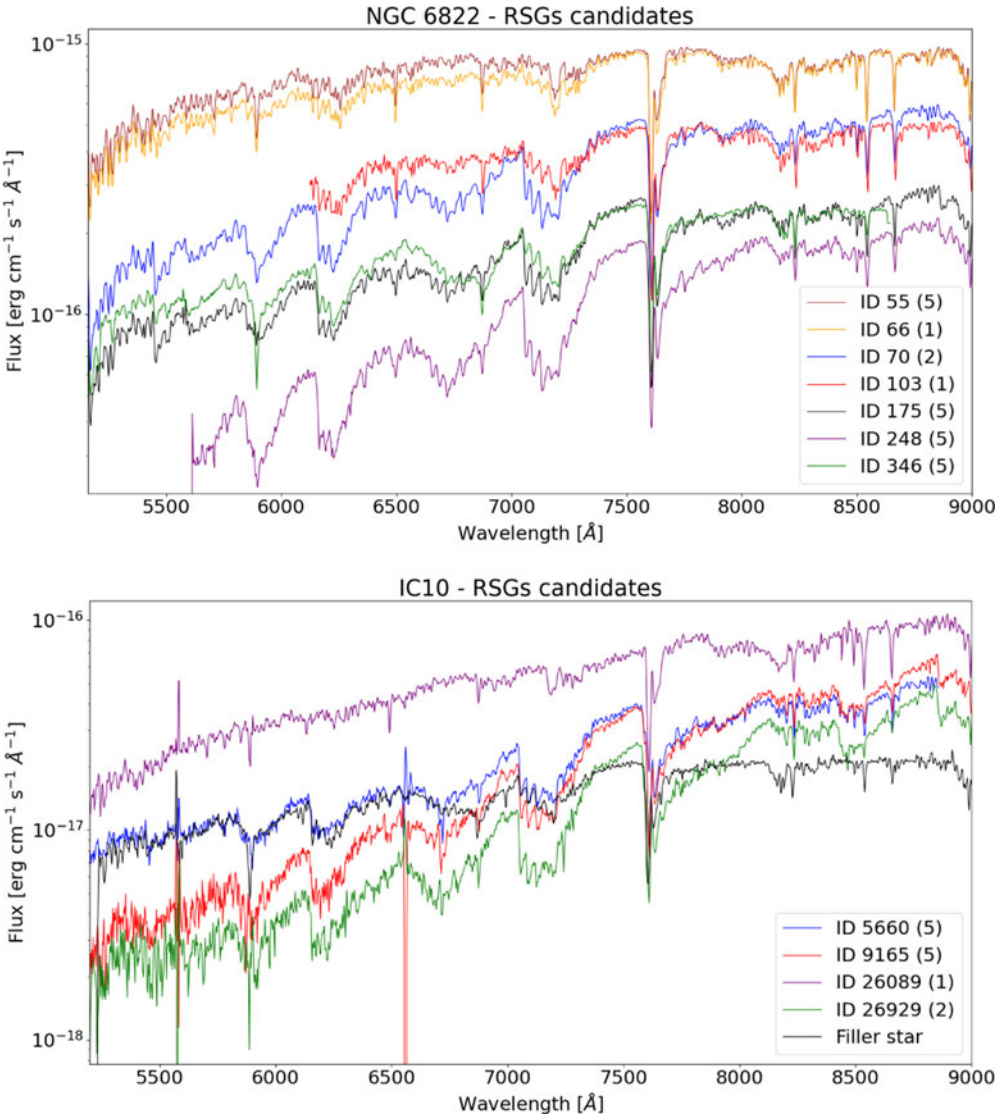


**Figure 1.** *Top*: RSG candidates in NGC 6822. *Bottom*: RSG candidates in IC 10. The number in parentheses corresponds to the priority.

https://doi.org/10.1017/S1743921322003155 Published online by Cambridge University Press

one pointing respectively, for a total of 90 minutes (1350s x 4 exposures) per field. We used IRAF for the data reduction and we treated each slit individually guaranteeing the correct processing of the data. After a first spectral classification by visual inspection, we found different types of stars such as RSGs, two OB-stars within a HII region, several carbon stars and a WR star. As the RSG was the most common type in both galaxies, we decided to present the most luminous ones in this work (Fig. 1). The spectra show the CaII triplet at 8498 Å, 8542 Å and 8662 Å and most of them have the TiO molecular bands at 6150 Å and 7054 Å. We will use Gaia DR3 to confirm with parallaxes and proper motions if these stars belong to the host galaxy candidate or if they are foreground stars.

## 3. Future work

In this contribution we have presented some results for the galaxies NGC 6822 and IC 10. However, the campaign with OSIRIS (GTC) is not completed yet, as we are waiting for the galaxies M 81, NGC 2403, NGC 4214 and NGC 4736 to be observed (proposal submitted). Once the sample is complete, we will obtain the parameters of these stars by modelling them and we will evaluate their properties with evolutionary tracks and their SED fitting.

## Supplementary material

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S1743921322003155.