Massive Stars Near and Far
Proceedings IAU Symposium No. 361, 2024
J. Mackey, J. S. Vink, & N. St-Louis, eds.
doi:10.1017/S1743921322002654

Apparently isolated massive stars within Galactic HII regions

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Abstract. The Alicante Survey of MAssive Stars in HII Regions (A-SMASHeR) is aimed at finding the ratio of massive stars that are born in isolation. We present LIRIS/WHT images and EMIR/GTC spectra of the massive stellar content in A-SMASHeR regions. Our preliminary analysis yields $\sim 20\%$ of regions hosting relatively (or truly) isolated massive stars.

Keywords. stars: formation, HII regions, infrared: stars, surveys, techniques: spectroscopic, techniques: photometric, open clusters and associations: general

1. Introduction

Massive stars mostly belong to clusters or OB associations, and it has been suggested that even field massive stars are born in clustered enviroments from which they have been ejected (Gvaramadze *et al.* 2012). Investigating whether these isolated objects can be formed in situ is crucial for determining which is the dominant mechanism (competitive collapse vs. monolithic accretion) of massive star formation (Zinnecker & Yorke 2007).

Massive stars that are still embedded in the cloud where they were born can be found in studies of the stellar content of HII regions. Following this approach, Oey *et al.* 2013 found such objects, some of them isolated, in the Small Magellanic Cloud (SMC). However, infrared studies of HII regions in the Milky Way are required to rule out compact clusters of massive stars, because such groups may be hard to resolve in the SMC.

2. The A-SMASHeR data

A-SMASHeR (Marco *et al.* 2019) is a homogeneous survey of Galactic HII regions whose objective is estimating the fraction of massive stars that are born in isolation. Further details are provided by Marco *et al.* (these proceedings).

Fig. 1 displays two representative examples of the A-SMASHeR content: a compact cluster of candidate massive stars; and a relatively isolated ionizing source. On the other hand, Fig. 2 shows part of the spectra of three A-SMASHeR point sources. Despite the dominance of nebular lines, we find features that allow us to constrain the nature and

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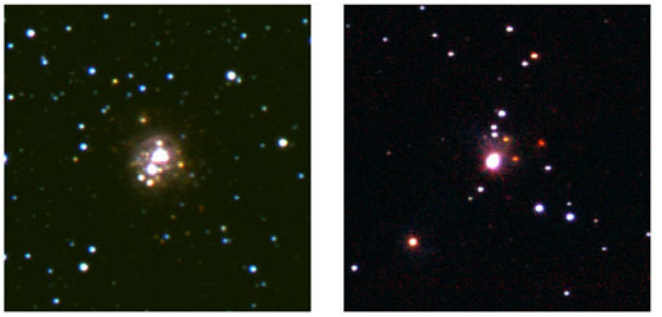

Figure 1. LIRIS/WHT infrared JHK_S images, sized $1' \times 1'$, of two A-SMASHeR targets: a compact cluster *(left)* and a relatively isolated central star surrounded by sparsely distributed faint objects *(right)*.

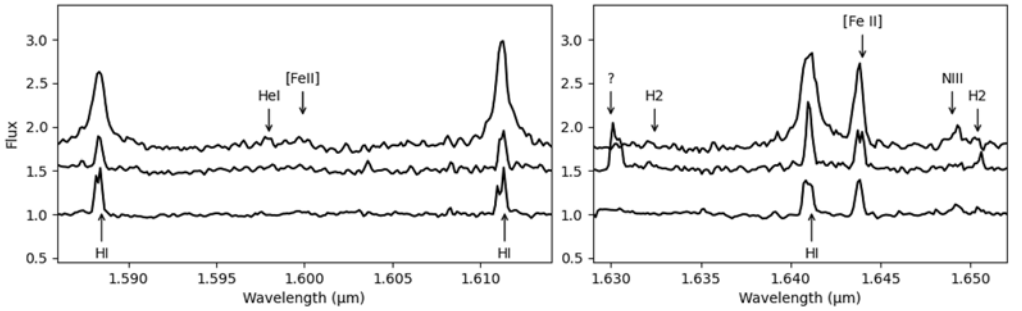

Figure 2. Selected portions of EMIR/GTC H-band spectra of A-SMASHeR targets. Although not being shown here, the K band is also observed by EMIR/GTC.

spectral type of the underlying star. For example, the double-peaked emission lines that point at a circumstellar disk, and the presence or absence of certain metallic lines.

3. Preliminary results and future work

Preliminary analysis yields $\sim 20\%$ of A-SMASHeR regions being ionized by a relatively isolated massive star, although most of them are part of more extended star-forming regions hosting other young objects. Final results will be produced after our planned follow-up multi-object spectroscopy with MIRADAS/GTC (Eikenberry *et al.* 2016), whose multiplexing capability is crucial for the A-SMASHeR variety of regions, ranging from compact clusters to truly isolated stars.

Acknowledgements. Financial support for this work has been provided by Generalitat Valenciana through grants APOSTD/2020/228 and APOSTD/2020/247, and by the Spanish Government projects PGC2018-093741-B-C21/C22.

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https://doi.org/10.1017/S1743921322002654 Published online by Cambridge University Press