Wolf-Rayet Stars
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The Wolf-Rayet stars WR 102c and 102ka and their isolation

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While the majority of very massive stars is clearly found in clusters, there are also very massive objects not associated with any cluster, suggesting they may have been born in isolation. In order to gain more insights, we studied the regions around two WR stars in the Galactic Center region. To understand the nature of the potential cluster around massive stars, photometry alone is not sufficient. We therefore used the ESO VLT/SINFONI integral field spectrograph to obtain photometry and spectra for the whole region around our two candidate stars. In total, more than 60 stars have been found and assigned a spectral type.

1 Introduction

It is commonly assumed that massive stars form in clusters or at least associations. Thus, when massive stars are found to be located in isolation, one would expect them to be either in an unknown cluster or be run-away stars that were kicked out from their birth-cluster. The second scenario can have several reasons, e.g. tidal disruption by a strong (external) potential like in the Galactic Center (GC) region or close binary interaction within the parental cluster.

Our first target star, WR 102c, had been discovered about 3 pc outside the Quintuplet cluster (Figer et al. 1999) while the other, WR 102ka, was found far off all known clusters in the region (Homeier et al. 2003).

2 Observations and data reduction

We used the K-Band filter ($\lambda = 2 - 2.45\,\mu$m) of SINFONI in the Near Infrared (NIR) which has a Resolving Power of $R = 4000$. For a clear identification of stars we found a limiting magnitude of $K_s \approx 14.5$ mag. Our field of view was about 1.3×1.3 pc, centered on WR 102c and 1.3×1.45 pc around WR 102ka, respectively.

The calibration was done by use of B type main-sequence stars of known spectral type, so we could use the Potsdam Wolf-Rayet code for expanding stellar atmospheres (PoWR) to model their spectra. During this process the telluric lines were also removed from the data cubes. For details, see section 2 of Oskinova et al. (2013).

3 Analysis and results

The cool stars were classified accoring to a scheme given by González-Fernández et al. (2008) which mainly makes use of the CO absorption band around $\lambda = 2.29\,\mu$m. That also allowed us to distinguish between super giants and giants.

By use of the PoWR code we analysed the early type stars and found the following results: WR 102c is a hot, evolved, hydrogen-free WN star with typical parameters (see Steinke et al., in prep.). The OB-type stars were found to be main-sequence stars near the turn-off point ranging between 12 and 27 solar masses with temperatures in the order of $15 - 25$ kK. WR 102ka is an Ofpe/WN9-10 star with a relatively low effective temperature of about 25 kK but an unusually high (present day) mass of about $100\,M_\odot$, resulting in a luminosity of $L = 10^{6.5}\,L_\odot$.

4 Summary and conclusions

In total we found 25 stars within a radius of about 1.3 pc around WR 102c, and 37 around WR 102ka in a similarly sized region. From the spectral analysis, including radial velocities, we conclude that the early-type stars of the 102c-field are likely to be members of a common cluster or association while the late-type stars (K and M giants) are identified as field stars of the GC region with a large velocity scatter.

Our observations confirm the isolation of WR 102ka as there is no massive star nearby.

References

Figer, D. F., McLean, I. S., & Morris, M. 1999, ApJ, 514, 202

González-Fernández, C., Cabrera-Lavers, A., Hammersley, P. L., & Garzón, F. 2008, A&A, 479, 131

Homeier, N. L., Blum, R. D., Pasquali, A., Conti, P. S., & Damineli, A. 2003, A&A, 408, 153

Oskinova, L. M., Steinke, M., Hamann, W.-R., et al. 2013, MNRAS, 436, 3357