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Improved distances and structure of several Galactic star-forming fields

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Abstract. We summarize results of precision photometry studies of prominent Galactic star-forming regions. The reliable *uvbyβ* photometry-based parallaxes we utilize for our purpose not only provide a significant revision of the OB-star distribution, but also help to identify previously undetected OB-groups.

Key words. Stars: distances – Stars: OB groups – Galaxy: star-forming regions

1. Introduction

Optical observations of Galactic young clusters and OB associations provide reliable distances for these objects, and thus structural details in the overall study of the Galactic recent star-formation sites. The distance estimates of the young Galactic groups are usually based on spectroscopic or photometric parallaxes of individual members. Among the wide variety of photometric system, the *uvbyβ* photometry (Strömgren 1966; Crawford & Mander 1966) is arguably better suited to the study of individual stars (and their groupings) in terms of stellar luminosity than any other photometric system in wide use. As pointed out in a number of occasions (cf. for example Kaltcheva & Golev (2012) and the references therein) the *uvbyβ* photometry-based parallaxes are in agreement with the *Hipparcos* parallaxes over the entire B0-B9 spectral range. Contrary to that, the spectroscopic magnitudes may overestimate the intrinsic stellar brightness by as much as 1.5 mag and thus to overestimate the distance to the Galactic star-forming fields.

2. Findings

2.1. Northern Monoceros

Toward the Rosette Nebula and the Monoceros Loop SNR, we identify a new OB-group of at least 12 members at a distance of 1.26 ± 0.2 kpc. The group is possibly connected to the Loop (Kaltcheva & Golev 2011). The obtained photometric distance is in excellent agreement with a recent independent distance estimate of 1.25 ± 0.19 kpc to the Monoceros Loop reported by Borka Jovanović & Urošević (2009).

2.2. Carina arm tangent

We obtain revised distances and average extinction for the open clusters and cluster candidates NGC 3293, NGC 3114, Lodén 46, and Lodén 112 located toward the Carina arm tangent ($280^\circ \leq l \leq 286^\circ$). The cluster candidate Lodén 112 appears to be a very compact group at 1629 ± 80 pc, significantly closer than previous estimates. We found other OB-stars at that same distance and, based on their proper motions, suggest a new OB association at coordinates $282^\circ < l < 285^\circ$ and $-2^\circ < b < 2^\circ$ (Kaltcheva & Golev 2012). This field clearly stands apart from the large H II features toward Car OB1 (η Car complex) and contains several smaller but prominent H II nebulosities, among which RCW 48 and RCW 49. However, it is difficult to judge if the new group is spatially connected to these H II regions, or is foreground.

Our analysis favors a distance of 6.4 ± 0.5 kpc (for $R = 3.2$) to the highly reddened young cluster Westerlund 2 which is found at the center of RCW 49. This estimate is in excellent agreement with the kinematic distance to the GMC-8 (Grabelsky et al. 1988; Dame 2007) detected in direction of Westerlund 2. However, this estimate could be strongly influence by the adopted value of R. A value of R around 4.8 would locate the cluster near 2 kpc.

2.3. Norma OB1 association

Toward Norma ($325^\circ - 335^\circ$ galactic longitude) we refine the distance to several young groups and clusters, including the Nor OB1 association. At about 860 pc, the stellar sample we use delineates a segment consistent with the location of the Sagittarius-Carina arm. A small part of the sample defines the near edge of the Scutum-Crux arm at about 1.75 kpc (Kaltcheva 2009). This stellar spatial distribution seems to be in agreement with the location and separation of the spiral arms toward Norma in the four-arm model representation of the grand design of the Milky Way (Vallée 2008).

2.4. Centaurus star-forming field

Toward Centaurus Star-Forming Field ($300^\circ \leq l \leq 312^\circ$) we establish a homogeneous distance scale for nearly 700 O-B9 type stars. We are able to select spatially coherent stellar groupings and to entirely revise the classical concept of the Cen OB1 association. We argue that this star-forming field is closer to the Sun than estimated before, at a median distance of 1.8 ± 0.5 kpc (r.m.s.), instead of the classical 2.5 kpc (Kaltcheva et al. 2012). The region shows striking similarities between the stellar distribution and H II and H I emission morphologies, suggesting that we observe the H I supershell GSH 305+01-24 behind the Coalsack together with its H II precursor shell (McClure-Griffiths et al. 2001; Silich et al. 2008). The shell morphology and the distribution of the OB-stars suggest a wind-driven H II region.

More details on these and additional fields can be found in Kaltcheva & Golev (2011) and the references therein.

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