



VVV high proper motion survey

M. Gromadzki¹, R. Kurtev¹, S. Folkes^{1,2}, J. C. Beamín³, K. Peña Ramírez⁴,
J. Borissova¹, D. Pinfield², H. Jones², D. Minniti^{3,5,6}, and V. D. Ivanov⁷

¹ Departamento de Física y Astronomía, Facultad de Ciencias, Universidad de Valparaíso, Ave. Gran Bretaña 1111, Playa Ancha, Valparaíso, Chile
e-mail: mariusz.gromadzki@uv.cl

² Centre for Astrophysics Research, Science and Technology Research Institute, University of Hertfordshire, Hatfield AL10 9AB, United Kingdom

³ Instituto de Astrofísica, Facultad de Física, Pontificia Universidad Católica de Chile, Avda. Vicuña Mackenna 4860, 782-0436 Macul, Santiago, Chile

⁴ Instituto de Astrofísica de Canarias, C/. Vía Láctea s/n, E-38205 La Laguna, Tenerife, Spain

⁵ The Milky Way Millennium Nucleus, Avda. Vicuña Mackenna 4860, 782-0436 Macul, Santiago, Chile

⁶ Vatican Observatory, Vatican City State V-00120, Italy

⁷ European Southern Observatory, Avda. Alonso de Cordoba 3107, Casilla 19001, Santiago, Chile

Abstract. Here we present survey of proper motion stars towards the Galactic Bulge and an adjacent plane region base on VISTA-VVV data. The searching method is based on cross-matching photometric K_s -band CASU catalogs. The most interesting discoveries are shown.

Key words. Stars: low-mass stars and Brown dwarfs – Proper motion – Infrared: Surveys

1. Introduction

High proper motion searches is the most widespread method of revealing new solar neighbors, as nearby stars generally have larger proper motions than those more distant. The Galactic bulge and plane are referred as the zone of avoidance, because they contain very high stellar densities down to faint limiting magnitudes, and also regions of dark molecular clouds, nebulosity, as well as regions of current star formation. Most of nearby stars are found outside these regions. However, re-

cent discoveries of nearby UCDs in Galactic plane, DENIS J081730.0-615520 (Artigau et al. 2010), UGPS J072227.51-054031.2 (Lucas et al. 2010) and Luhman 16 (Luhman 2013), show that these regions may contain other highly interesting, unusual, and nearby objects.

2. VISTA-VVV

The ESO public survey VISTA Variables in the Vía Láctea (VVV) targets 562 square degrees in the Galactic Bulge and an adjacent plane region (Minniti et al. 2010; Saito et al. 2012). VVV provides multi-epoch K_s -band images

Send offprint requests to: M. Gromadzki

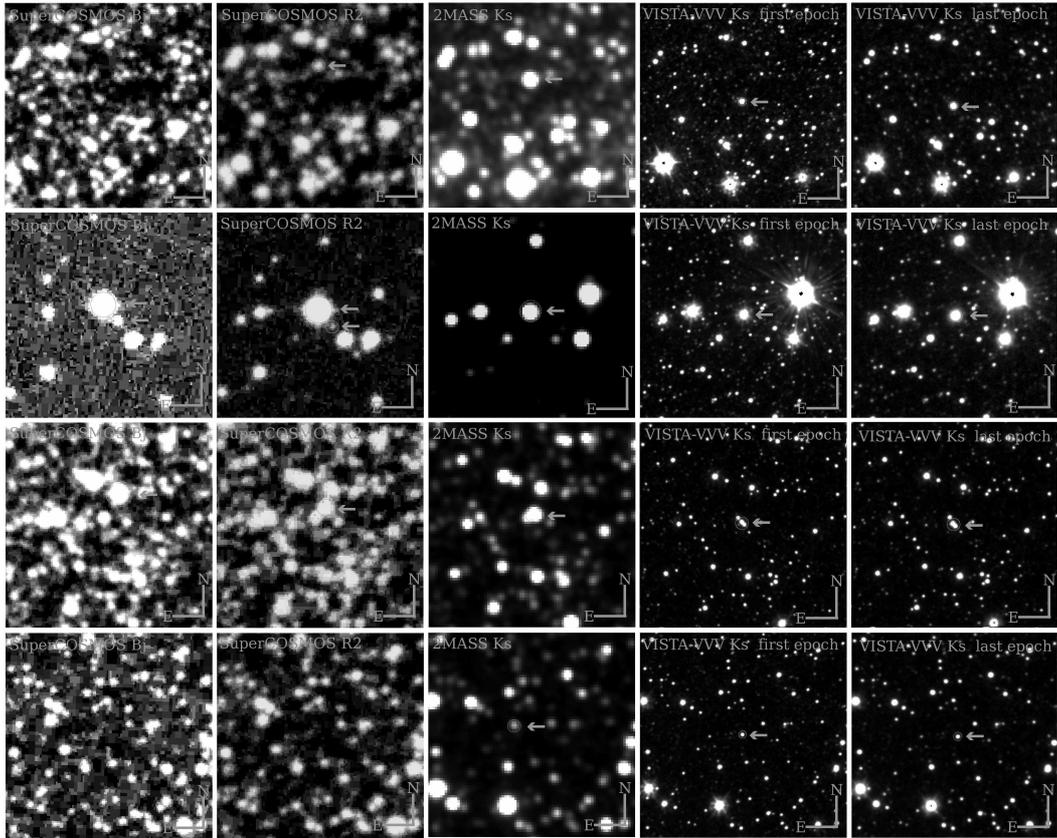


Fig. 1. Examples of most interesting discoveries. Row 1: High proper motion ($0''.81 \text{ yr}^{-1}$) M dwarf towards the Galactic Bulge. Row 2: dM+WD common proper motion binary, WD is visible only on SuperCOSMOS images ($B_j=20.3$, $R_2=21.1$). Row 3: Close common proper motion dM+MD binary ($d = 1''.6$) resolved on VISTA-VVV images. Row 4: Brown dwarf towards the Galactic Bulge, object is not visible on SuperCOSMOS images.

which allow searching for high proper motion objects. Providing better spatial resolution and deeper (4) magnitude range than 2MASS, VVV has bigger potential of finding free floating very low-mass stars, brown dwarfs and also common proper motion companions of previously known high proper motion stars. The VVV data are processed by the Cambridge Astronomical Unit¹ (CASU). CASU provides images and catalogs with aperture photometry and astrometry for VVV users. The VVV data are also publicly available through the VISTA

Science Archive² (VSA). More technical information about the VVV survey can be found in Saito et al. (2012) and Soto et al. (2013).

3. Method

The searching method we used is based on cross-matching, with a scaled radius of 5 arc-sec per year, photometric K_s -band CASU catalogs obtained for 4 different epochs. Method was developed by Folkes et al. (in preparation).

¹ <http://casu.ast.cam.ac.uk/vistasp/>

² <http://horus.roe.ac.uk/vsa/index.html>

Next, the candidates were visually inspected on VVV, 2MASS and SuperCOSMOS images.

4. Current status

Until Jun 2013, we have examined $\sim 31\%$ of VVV area and we have detected ~ 400 objects with proper motion higher than 0.05 arcsec per year and $K_s < 13.5$. This sample includes dozens of completely new high proper motion stars and common proper motion pairs, some common proper motions companions of previously known high proper motion stars, and one spectroscopically confirmed brown dwarf (Beamín et al. 2013). During visual inspection of SuperCOSMOS images we have also identified 3 white dwarf common proper motion companions of previously known high proper motion stars.

The examples of most interesting discoveries are presented on Figure 1. SuperCOSMOS B_j and R_2 , 2MASS K_s and VISTA-VVV first and last K_s epoch images were obtained around 1974, 1992, 2000, 2010 and 2012, respectively.

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References

- Artigau, É., Radigan, J., Folkes, S., et al. 2010, *ApJ*, 718, L38
 Beamín, J. C., et al. 2013, *A&A*, submitted
 Lucas, P. W., Tinney, C. G., Burningham, B., et al. 2010, *MNRAS*, 408, L56
 Luhman, K. L. 2013, *ApJ*, 767, L1
 Minniti, D., Lucas, P. W., Emerson, J. P., et al. 2010, *New Astronomy*, 15, 433
 Saito, R. K., Hempel, M., Minniti, D., et al. 2012, *A&A*, 537, A107
 Soto, M., Barbá, R., Gunthardt, G., et al. 2013, *A&A*, 552, A101