

Data Collection	VMC_MPHOT_Ks
Release Number	2
Data Provider	Maria-Rosa Cioni
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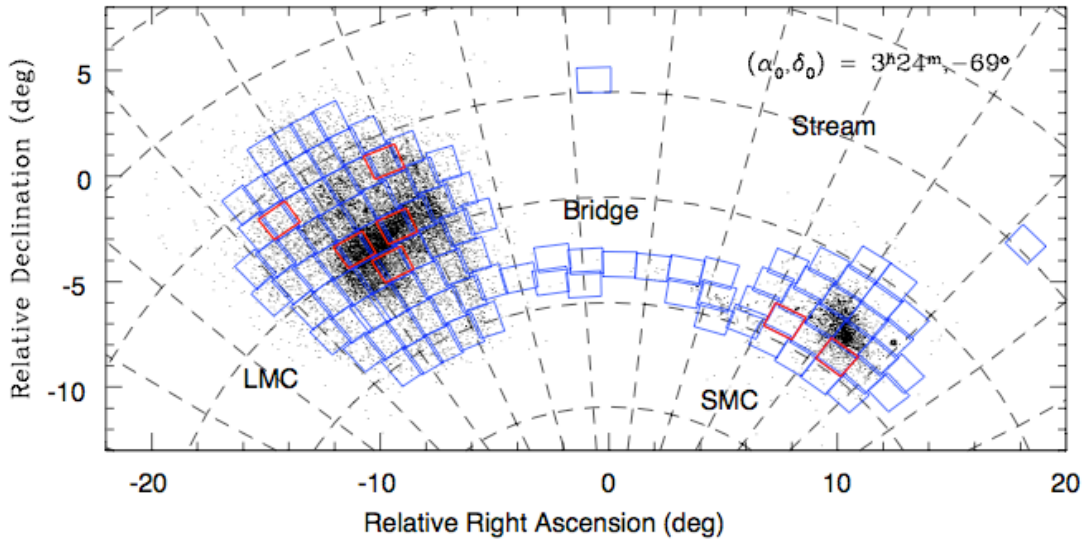
Abstract

Observations were obtained with the VISTA telescope as part of the VISTA survey of the Magellanic Cloud system (VMC; ESO program 179.B-2003) in three filters: Y, J and K_s. The main goals of the VMC survey are the determination of the spatially resolved star formation history and the three-dimensional geometry of the Magellanic system. The sensitivity of the data is designed to reach sources below the oldest main-sequence turn off point of the stellar population and the multi-epochs to measure accurate K_s mean magnitudes for pulsating variable stars, e.g. RR Lyrae stars and Cepheids.

This catalogue data release refers to five new individual tile images for VMC tiles completed by October 2012 (tiles LMC 5_5, 6_4, 8_3, and SMC 3_3, 3_5) and the two re-processed tiles LMC 6_6 and 8_8. These images refer to at least twelve epochs in K_s band. The total sky coverage of this release is ~7.5 deg² in the LMC and ~3 deg² in the SMC.

Overview of Observations

The figure below shows the Magellanic system as tiled by the VMC survey (blue) and tiles for which catalogues are released (red). Underlying small dots indicate the distribution of carbon stars, stellar clusters and associations.



Tile numbering begins from the bottom right corner, increasing from right to left and from bottom to right. The first LMC tile is 2_3, the first SMC tile is 2_2, the first Bridge tile is 1_2 and Stream tile 1_1 is right above the Bridge while 2_1 is to the right of the SMC.

Release Content

This catalogue release covers five tiles in the Large Magellanic Cloud: LMC 5_5, 6_4, 6_6, 8_3 and 8_8, as well as two tiles in the Small Magellanic Cloud: SMC 3_3 and 3_5.

LMC tiles were oriented with the Y axis more or less along the declination direction while for SMC tiles the Y axis is along the right ascension direction. Each tile covers about 1.771 deg^2 where the central $(1.475 \times 1.017) = 1.501 \text{ deg}^2$ corresponds to the nominal depth of the survey and the remaining area to half the exposure time in each band.

Tile identification, number of records, size in Mby and limiting magnitude corresponding to sources with photometric errors $< 0.1 \text{ mag}$ are listed below.

Tile	Records	Mby	Ks
SMC 3_3	4393478	279	18.8351
SMC 3_5	1301926	83	18.7651
LMC 5_5	4110385	261	18.8038
LMC 6_4	12783783	811	18.4149
LMC 6_6	10323169	655	18.4913
LMC 8_3	8973562	570	18.4983
LMC 8_8	2892121	184	18.7690

Release Notes

The data for this release were prepared by the Wide Field Astronomy Unit (WFAU) and the VMC team from images initially processed by the Cambridge Astronomy Survey Unit (CASU).

The main processing steps are described in Cross et al. (2012, A&A 548, A119) and Cross et al. (2009, MNRAS 399, 1730). Multi-epoch catalogues were extracted from individual tile images using the software suite provided by CASU (v1.3) and outgusted from the VISTA Science Archive.

Data Reduction and Calibration

The procedures to reduce and calibrate the data are described in detail at: <http://casu.ast.cam.ac.uk/surveys-projects/vista/technical/data-processing>.

In particular, catalogues were created from images that were filtered for nebulosity with size of the order of 30 arcsec (Irwin 2010, UKIRT Newsletter 26, 14).

The magnitudes were not corrected for reddening.

Data Quality

The astrometric and photometric quality of the data is described in detail at <http://casu.ast.cam.ac.uk/surveys-projects/vista/technical>.

In addition, the quality error bit flags assigned during post processing are listed at <http://horus.roe.ac.uk/vsa/ppErrBits.html>. These flags refer to quality issues of varying severity. For each pass-band nine quality issues are implemented as follows, where the corresponding value of the kspErrBit is given in parenthesis. Source is deblended source (16), has bad pixel(s) in default aperture (64), has low confidence in default aperture (128), lies within detector #16 region of a tile (4096), is close to saturation (65536), has photometric calibration probably subject to systemic errors (131072), lies within a dither offset of the stacked frame boundary (4194304), lies within the underexposed strip of a tile (8388606), and lies within an underexposed region of a tile due to missing detector (16777216).

To select only sources without quality issues the user can filter on `ksppErrBits = 0`, but note that the majority of the sources will have at least `ksppErrBits=16` due to the dense stellar field, and to include only sources with minor quality issues use `ksppErrBits < 256`.

Known issues

These VISTA data may present the following issues, for which a full description is given in <http://casu.ast.cam.ac.uk/surveys-projects/vista/technical/known-issues>. A variable depth due to bad pixels in detectors #1, #4 and #16 as well as some bad rows. Point-like objects residuals of flatfielding, variable vignetting and spurious detections around bright stars. Some of these issues are recorded in the quality error bits flags assigned during post processing.

The astrometry in these deep tiles suffer from a complex 10-20 mas systematic pattern due to residual WCS errors from the component pawprints of individual tiles and prior to 01.08.2012 to an inconsistent use of the ZPN projection, which results in a complex residual radial distortion of up to +/- 100 mas.

The K_s tile magnitudes extracted for the Cepheids studied in Ripepi et al. (2012) differ from those listed in the paper because in that study they correspond to the mean pawprint magnitudes from an earlier processing of the VMC data. Note also that the time coordinate indicated in this release is MJD while HJD is listed in the Ripepi et al. (2012) paper.

The K_s tile magnitudes extracted for Eclipsing Binaries studied in Muraveva et al. (2014) may differ from those listed in the paper because in that study they correspond to the tile magnitudes from an earlier processing of the VMC data.

Previous Releases

The previous catalogue Data Release (1) referred to catalogues extracted from the reduced images available in VMC Data Release 2. The present catalogue Data Release (2) refers to catalogues extracted from the reduced images available in VMC Data Release 3.

Data Format

Files Types

Multi-epoch source catalogues in K_s , one per tile, are released:

```
vmc_er3_00h44-074d12_ks_mPhot_558345748487.fits  
vmc_er3_01h27-074d00_ks_mPhot_558345748486.fits  
vmc_er3_05h04-066d15_ks_mPhot_558345748481.fits  
vmc_er3_05h12-069d16_ks_mPhot_558345748483.fits  
vmc_er3_05h24-070d48_ks_mPhot_558345748485.fits  
vmc_er3_05h37-069d22_ks_mPhot_558345748484.fits  
vmc_er3_05h59-066d20_ks_mPhot_558345748482.fits
```

where the name is constructed as `project_release_ra/dec_band_typeofCat_framesetID.fits` and `framesetID` uniquely identifies the tile as follows:

```
558345748487 SMC 3_3  
558345748486 SMC 3_5  
558345748481 LMC 8_3  
558345748483 LMC 6_4  
558345748485 LMC 5_5  
558345748484 LMC 6_6  
558345748482 LMC 8_8.
```

A MetaData file, `vmc_er3_ks_mPhotMetaData.fits`, accompanies the release. Its name refers to `project_release_band_typeofCat.fits`.

Catalogue Columns

Each epoch-merged and band-merged catalogue contains the following columns.

Number; name; format; description

1; PHOT_ID; K; Unique identifier for epoch observation. Combination of source UID and detection UID

2; IAUNAME; 36A; Unique identifier in IAU naming convention

3; SOURCEID; K; UID of this merged detection

4; MJD; D; Modified Julian Day in Ks band

5; KSMAG; E; Default point/extended source Ks aperture corrected mag (2.0 arcsec aperture diameter)

6; KSERR; E; Error in default point/extended source Ks mag (2.0 arcsec aperture diameter)

7; KSPERRBITS; J; additional WFAU post-processing error bits in Ks

The format refers to the fits notation as follows:

A - string 32 characters; D - double floating point (8 bytes); E - real floating point (4 bytes); I - short integer (2 bytes); J - integer (4 bytes); K - long integer (8 bytes).

Acknowledgements

Please reference Cioni et al. 2011, *A&A*, 527, A116 and use the following statement in your articles when using these data: Based on data products from observations made with ESO Telescopes at the La Silla Paranal Observatory under programme ID 179.B-2003.