UKIDSS’ counterpart in the South

Jim Emerson
Queen Mary, University of London
• At end of 1990s UK wide field astronomy community decided that it needed deep and wide near-IR surveys in both hemispheres.
• UKIDSS came first on the existing UKIRT
• VISTA came later on a new telescope
• Similar filters except VISTA $K_s$ instead of $K$
• VISTA has higher throughput as telescope purpose built for the camera
Six Public Surveys:
1 Hemisphere, 2 Galactic, 3 Extragalactic

- Ultra-VISTA: Ultra-deep extragalactic survey
  – 1 field = COSMOS. Y, J, H, Ks + narrowband 1.18 µm.
  – 0.75 deg$^2$ gets ¾ of time (~ 200 hrs / filter).

- VIDEO: VISTA Deep Extragalactic Observations
  – 12 deg$^2$, 3 SWIRE+SERVS+HERMES fields. "SDSS at z ~ 1 - 2".

- VIKING: VISTA Kilo-degree Infrared Galaxy survey
  – 1500 deg$^2$, extragalactic, ~ 2dFGRS stripes. ~ 400 sec / filter.

- VHS: VISTA Hemisphere Survey
  – ~ 18,000 deg$^2$, ~ 60 – 120 sec/filter.

- VMC: Magellanic Clouds + bridge:
  – 180 deg$^2$, ~ 40 min – 2 hr per filter.

- VVV: VISTA Variables in Via Lactea
  – 520 deg$^2$, Bulge + plane, multi-epoch for variables.
## Phase 3 Data Releases

### Overview

<table>
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<th>Data Release</th>
<th>Release Date</th>
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<tr>
<td>VISTA Variables in the Via Lactea Survey (VVV) - Data Release 1</td>
<td>25.07.2011</td>
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<td>VISTA Deep Extragalactic Observations Survey (VIDEO) - Data Release 1</td>
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<td>VISTA Magellanic Survey (VMC) - Data Release 1</td>
<td>25.09.2011</td>
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<tr>
<td>VISTA Hemisphere Survey (VHS) - Data Release 1</td>
<td>17.10.2011</td>
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Public data Release 1

This form provides access to reduced images released by the VISTA public survey projects and integrated into the ESO Science Archive Facility since April 2011, through the Phase 3 process.

To search for other ESO data products, please use the Canada Data Products and Imagery Data Products query forms.

Video XMM-LSS field 1.5 YJHKs

VMC

2 pointing in the LMC, one overlapping with 30 Doradus, one overlapping with South Ecliptic Pole.

3 YJKs

VVV

Coniguous patch of bulge and disk region including multi-epoch data in Ks 520 YJHKs

VHS

DES: 120 sec JHKs

ATLAS: 60 sec 1910 YJHKs

GPS: 60 sec YJHKs

UltraVISTA 1st year data 1.5 YJHKs NB118

VIKING Not yet available
UltraVISTA

1.5 deg² on COSMOS field

<table>
<thead>
<tr>
<th>Filter</th>
<th>Av. Exposure per. pixel</th>
<th>Mean FWHM (&quot; +/- 0.1&quot;)</th>
<th>5-sigma 2&quot; ap. (AB MAG; +/- 0.1 mag)</th>
<th>95% completeness</th>
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<tbody>
<tr>
<td>Y</td>
<td>42360</td>
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<td>24.6</td>
<td>24.2</td>
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<tr>
<td>J</td>
<td>49720</td>
<td>0.79</td>
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<td>H</td>
<td>42520</td>
<td>0.76</td>
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<td>K</td>
<td>39400</td>
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<td>23.7</td>
<td>23.8</td>
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<td>NB118</td>
<td>23773</td>
<td>0.75</td>
<td>22.9+/-.0.2</td>
<td>TBD</td>
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<table>
<thead>
<tr>
<th>Lead author</th>
<th>Reference</th>
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<tr>
<td>Bowler et al</td>
<td>arXiv:1205.4270</td>
<td>Discovery of bright $z \sim 7$ galaxies in the UltraVISTA survey</td>
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<td>Fleuren et al</td>
<td>arXiv:1202.3891</td>
<td>Herschel-ATLAS: VISTA VIKING near-infrared counterparts in the Phase 1 GAMA 9-h data</td>
</tr>
<tr>
<td>Findlay et al</td>
<td>2012MNRAS.419.3354F</td>
<td>Selection constraints on high-redshift quasar searches in the VISTA Kilo-degree Infrared Galaxy survey</td>
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</tbody>
</table>

Findlay et al. found the 2\textsuperscript{nd} 3\textsuperscript{rd} & 4\textsuperscript{th} highest redshift quasars.
VISTA Magellanic Clouds Survey

(Ripepi et al arxiv:1204.2273)
Period – Luminosity relation in $K_s$

- Calibrate using objects of known distance

- $(m-M)_0 = 18.46 \pm 0.03$

- HST key project assumed 18.50

- $\Rightarrow$ LMC calibrated extragalactic distance scales are shorter by 2\% than assumed.

- 2012 review $\Rightarrow$ 18.48 pm 0.05

- Will use individuals to map structure
<table>
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<th>The VMC Survey</th>
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<tr>
<td>Ripepi et al</td>
<td>arXiv:1204.2273</td>
<td>V. First results for Classical Cepheids</td>
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<tr>
<td>Rubele et al</td>
<td>2011A&amp;A...537A..106M</td>
<td>IV. The LMC star formation history and disk geometry from four VMC tiles</td>
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<tr>
<td>Miszalski et al</td>
<td>2011A&amp;A...531A.157M</td>
<td>II. A multi-wavelength study of LMC planetary nebulae and their mimics</td>
</tr>
<tr>
<td>Cioni et al</td>
<td>2011A&amp;A...527A.116C</td>
<td>I. Strategy and first data</td>
</tr>
</tbody>
</table>

Tile 4_3 example

Goodness of fit
VVV VISTA Variables in the Via Lactea

- ~4 magnitudes deeper than 2MASS.
- Can reach red clump magnitude across the enNre bulge.
- VVV photometry allows us not only to trace the red clump even in the most extincted regions, but also to study the stellar populations behind the bulge.

=> study stellar populations and structure of the inner Galaxy to unprecedented level of detail, and derivation of accurate distances.

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<td>Gonzalez et al</td>
<td>Archiv1204.4004G</td>
<td>Reddening and metallicity maps of the Milky Way bulge from VVV and 2MASS II. The complete high resolution extinction map and implications for Bulge studies</td>
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<tr>
<td>Saito et al</td>
<td>2012A&amp;A...537A.107S</td>
<td>VVV DR1: The first data release of the Milky Way bulge and southern plane from the near-infrared ESO public survey VISTA variables in the Vía Láctea</td>
</tr>
<tr>
<td>Moni Bidin et al</td>
<td>2011A&amp;A...535A..33M</td>
<td>Three Galactic globular cluster candidates</td>
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<td>2011A&amp;A...534L..14G</td>
<td>The inner Galactic bar traced by the VVV survey</td>
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<tr>
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<td>2011A&amp;A...534A...3G</td>
<td>Reddening and metallicity maps of the Milky Way bulge from VVV and 2MASS. I. The method and minor axis maps</td>
</tr>
<tr>
<td>Borissova et al</td>
<td>2011A&amp;A...532A.131B</td>
<td>New Galactic star clusters discovered in the VVV survey</td>
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<tr>
<td>Minniti et al</td>
<td>2011ApJ...733L..43M</td>
<td>The Edge of the Milky Way Stellar Disk Revealed Using Clump Giant Stars as Distance Indicators</td>
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<tr>
<td>Minniti et al</td>
<td>2011A&amp;A...527A..81M</td>
<td>Discovery of VVV CL001. A low-mass globular cluster next to UKS 1 in the direction of the Galactic bulge</td>
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<tr>
<td>Minniti et al</td>
<td>2010NewA...15..433M</td>
<td>VISTA Variables in the Via Lactea (VVV): The public ESO near-IR variability survey of the Milky Way</td>
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Conclusion

• VISTA works as expected – the novel systems all work well
• First public data released
• Science papers published
• VISTA is making it’s complementary impact