VISTA Variables in the Via Lactea (VVV)

What is the structure of the inner bulge?
How did the MW form?

VVV is a proposed public survey to be carried out with VISTA at Paranal Observatory between 2007 and 2011. It will map repeatedly the entire Milky Way bulge, as well as the inner southern disk, covering a total area of about 600 sq deg containing $5x10^8$ point sources, 40 known globular clusters and more than one hundred known open clusters. The main survey products will be a JHK atlas of the MW bulge and inner disk, and catalogues of variable point sources and high proper-motion objects. The multi-epoch photometry will allow the identification and phasing of periodic variable stars, as well as microlensing events and planetary transits. We plan to unveil the 3-D structure of the inner bulge and disk of the MW using well understood distance indicators such as RR Lyrae stars and clump giants. The survey will also detect tens of star formation regions and allow to test the environmental dependence of star formation. The VISTA observations will be combined with data from MACHO, OGLE, EROS, 2MASS, DENIS, HST, SPITZER, CHANDRA, INTEGRAL, and in the future ALMA for a complete understanding of the variable star sources in the inner MW.

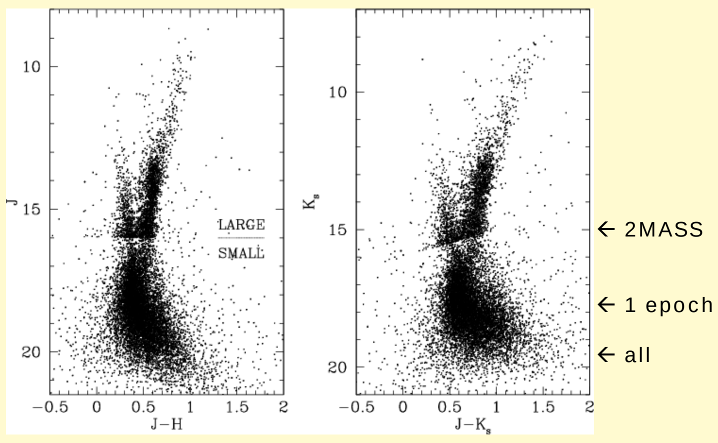

Figure 1. *JH and JK color-magnitude diagrams of a crowded bulge field obtained with NTT+ SOFI (Zoccali et al. 2003).*

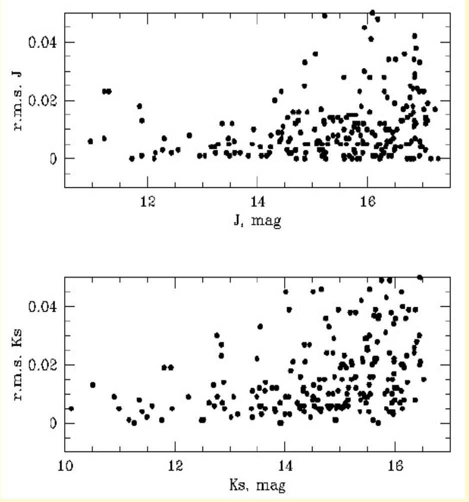

Figure 2. *JK photometric errors expected in bulge crowded fields based on observations acquired with NTT+SOFI using a similar strategy as planned. These will allow the identification of RR Lyrae in the bulge.*

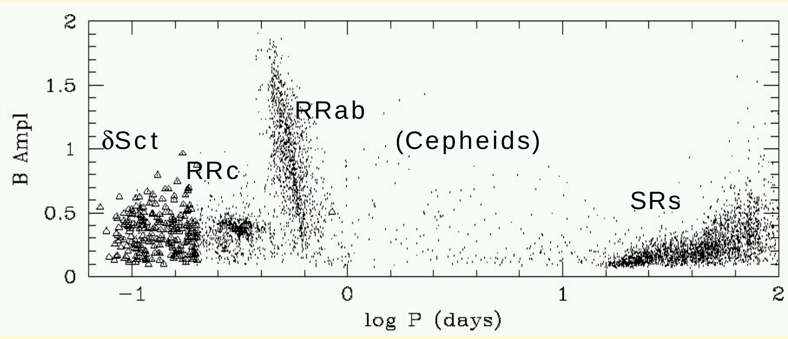

Figure 3. *MACHO pulsating variables in the direction of the MW bulge (Alcock et al. 1998). Magnitude, color, period and amplitude information allow reliable classification of variable stars.*

Table 1. Known globular clusters in the VVV fields: 1/3 of these clusters have uncertain distances (asteriscs).

IDName	RA	DEC	L	B	D(kpc)	
NGC6266	17 01 12.8	-30 06 49	353.57	7.32	6.9	
NGC6293	17 10 10.2	-26 34 55	357.62	7.83	8.8	
NGC6304	17 14 32.1	-29 27 44	355.83	5.38	6.0	
NGC6316	17 16 37.3	-28 08 24	357.18	5.76	11.0	
NGC6325	17 17 59.2	-23 45 57	0.97	8.00	8.0	
NGC6355	17 23 58.6	-26 21 13	359.58	5.43	9.5	
Terzan2	17 27 33.1	-30 48 08	356.32	2.30	8.7	
Terzan4	17 30 39.0	-31 35 44	356.02	1.31	9.1	*
HP1	17 31 05.2	-29 58 54	357.42	2.12	14.1	*
Liller1	17 33 24.5	-33 23 20	354.84	-0.16	9.6	*
NGC6380	17 34 28.0	-39 04 09	350.18	-3.42	10.7	
Terzan1	17 35 47.2	-30 28 54	357.56	0.99	5.6	
Ton2	17 36 10.5	-38 33 12	350.80	-3.42	8.1	*
NGC6401	17 38 36.6	-23 54 34	3.45	3.98	10.5	
Pal6	17 43 42.2	-26 13 21	2.09	1.78	5.9	
Djorg1	17 47 28.3	-33 03 56	356.67	-2.48	12.0	*
Terzan5	17 48 04.9	-24 46 45	3.84	1.69	10.3	*
NGC6440	17 48 52.7	-20 21 37	7.73	3.80	8.4	
NGC6441	17 50 12.9	-37 03 05	353.53	-5.01	11.7	
Terzan6	17 50 46.4	-31 16 31	358.57	-2.16	9.5	*
NGC6453	17 50 51.7	-34 35 57	355.72	-3.87	9.6	
UKS1	17 54 27.2	-24 08 43	5.12	0.76	8.3	*
Terzan9	18 01 38.8	-26 50 23	3.60	-1.99	6.5	*
Djorg2	18 01 49.1	-27 49 33	2.76	-2.51	6.7	*
Terzan10	18 02 57.4	-26 04 00	4.42	-1.86	5.7	*
NGC6522	18 03 34.1	-30 02 02	1.02	-3.93	7.8	
NGC6528	18 04 49.6	-30 03 21	1.14	-4.17	7.9	
NGC6540	18 06 08.6	-27 45 55	3.29	-3.31	3.7	
NGC6544	18 07 20.6	-24 59 51	5.84	-2.20	2.7	
NGC6553	18 09 17.6	-25 54 31	5.25	-3.03	6.0	
2MS-GC02	18 09 36.5	-20 46 44	9.78	-0.62	4.0	*
NGC6558	18 10 17.6	-31 45 50	0.20	-6.02	7.4	
Terzan12	18 12 15.8	-22 44 31	8.36	-2.10	4.8	*
NGC6569	18 13 38.8	-31 49 37	0.48	-6.68	10.7	
NGC6624	18 23 40.5	-30 21 40	2.79	-7.91	7.9	
NGC6626	18 24 32.9	-24 52 12	7.80	-5.58	5.6	
NGC6638	18 30 56.1	-25 29 51	7.90	-7.15	9.6	
NGC6637	18 31 23.2	-32 20 53	1.72	-10.27	9.1	
NGC6642	18 31 54.1	-23 28 31	9.81	-6.44	8.4	
NGC6656	18 36 24.2	-23 54 12	9.89	-7.55	3.2	

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VVV Top 10 goals:

To find RR Lyrae in the bulge
To study variables belonging to known clusters
To search for new star clusters
To map star forming regions along the plane
To find eclipsing binaries and planetary transits
To search for microlensing events
To identify rare variable X-ray sources
To monitor the variability around the Galactic Center
To find variable stars in the Sgr dSph galaxy
To identify background QSOs

(Also high proper motion objects, KBOs, Light Echoes)

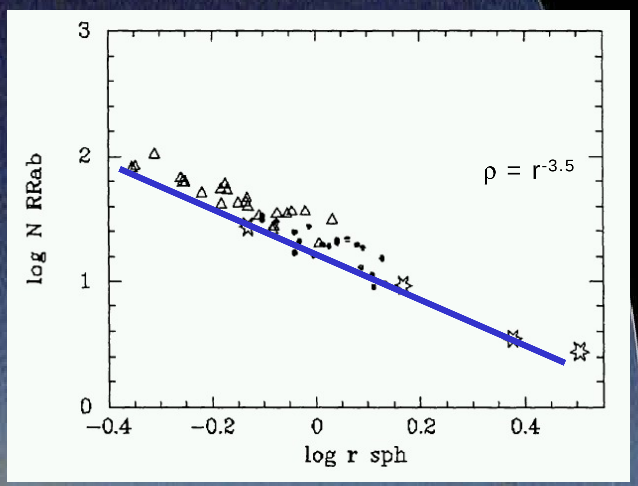

Figure 4: *RR Lyrae density distribution in the bulge (Minniti et al. 1998) . This distribution shows old and metal poor populations, but only outside 400 pc. Along with other tracers of metal-rich populations (e.g. clump giants), these can be used to test NFW profiles in the innermost MW.*

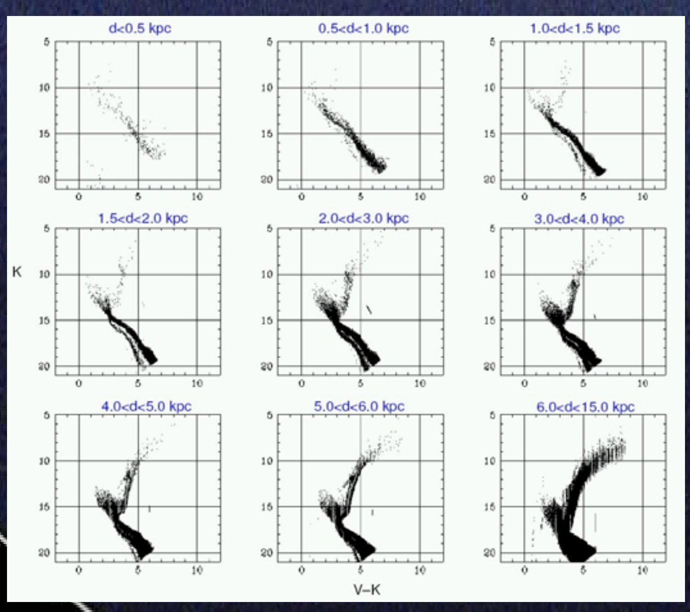

Figure 5. *CMD simulations along the line of sight to the bulge using Bensançon models. Contributions from the disk and bulge as well as reddening are included*

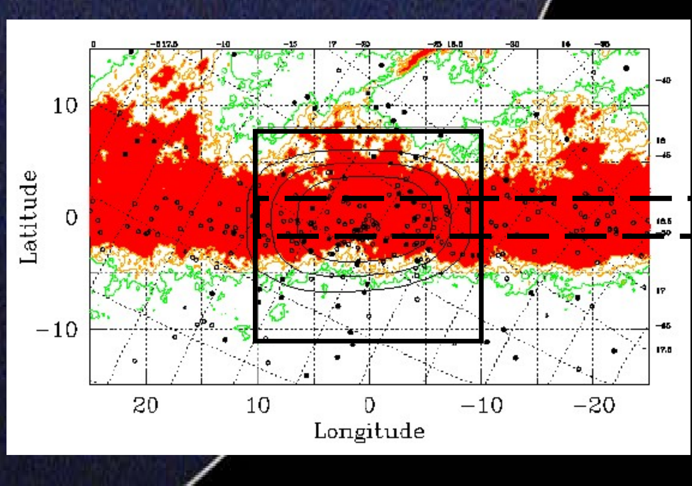

Figure 6. *Map of known globular and open cluster positions (full and empty circles). Bulge contours are indicated, as are the extinction maps of Schlegel et al. (1998).*

Background:
2MASS JHK map of the whole sky. The solid and dotted boxes show the VVV areas. The small rectangular box illustrates a single VISTA field at the Galactic center.