Mem. S.A.It. Vol. 80, 139

Memorie della

MAD@VLT observations in Layer Oriented mode: first results

A. Moretti[1], C. Arcidiacono[1], M. Lombini[2], G. Piotto[3], R. Falomo[1], J. Farinato[1], R. Ragazzoni[1], A. Baruffolo[1], and E. Marchetti[4]

[1] Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, I-35122 Padova, Italy, e-mail: alessia.moretti@unipd.it
[2] Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Bologna, Via Ranzani 1, I-40127 Bologna, Italy
[3] Dipartimento di Astronomia – Università di Padova, Vicolo dell'Osservatorio 3, I-35122 Padova, Italy
[4] European Southern Observatory – Karl-Schwarzschild-Strasse 2, D-85748 Garching bei Muenchen, Germany

Abstract. We present preliminary results obtained from the observations with MAD@VLT of the globular cluster NGC 6388. This study has two aims: first, to assess the capabilities of the Multi-Conjugate Adaptive Optics (MCAO) corrections in crowded fields photometry and, second, to couple the deepest ACS/HST optical observations with comparable NIR observations (in the K_s band), in order to distinguish multiple populations in the color-magnitude diagram of this massive cluster located close to the Galactic bulge.

Key words. Stars:Hertzsprung-Russell (HR) and C-M diagrams– globular clusters:general

1. Introduction

MAD is a prototype MCAO System that has been recently mounted at VLT (Marchetti et al. 2007) to test on sky the feasibility of different MCAO image reconstruction and correction techniques in view of future applications with the 2nd Generation VLT Instruments and E-ELT instrumentation. It is equipped with a 1 arcmin infrared camera scanning the corrected circular 2' Field of View (FoV). First results with MAD have been obtained using the Star Oriented (SO) Shack-Hartmann wavefront sensor (Bouy et al. 2008). We will analyze here the performances of the Layer Oriented (LO) multi pyramid sensor (Ragazzoni 1996; Ragazzoni et al. 2000; Vernet et al. 2005; Arcidiacono et al. 2007) that can use from 3 to 8 guide stars. For both sensors the stars can be placed over the 2' FoV. LO technique has the great advantage of having the possibility to use fainter ($V < 18$) stars (see Ragazzoni & Farinato 1999; Ghedina et al. 2003), with respect to SO ($V < 13$), thanks to the optical coaddition of the reference stars light on the LO sensor.

In September 2007 the LO wavefront sensor has been tested on sky for 9 consecutive nights. An external field in NGC 6388 has been observed for $\sim$ 5000 s to fully exploit the capabilities of the MCAO correction. The mag-

Send offprint requests to: A. Moretti

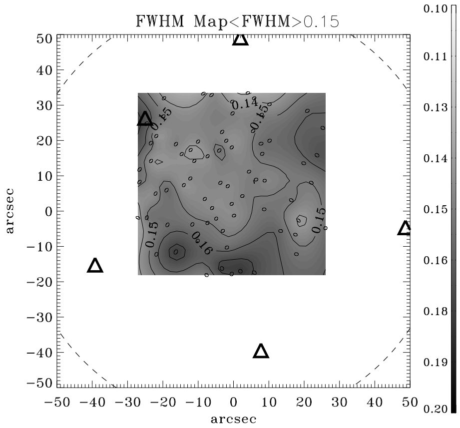

Fig. 1. FWHM map of the field of NGC 6388 that was observed with MAD. Triangles represent the MCAO reference stars.

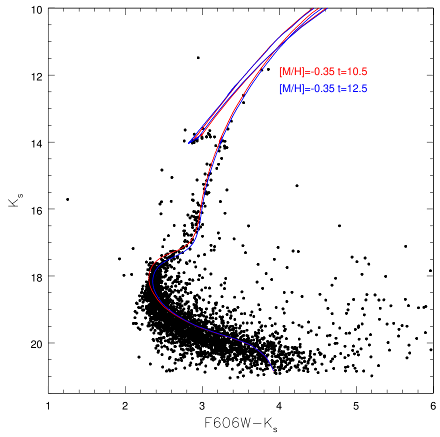

Fig. 2. Color–magnitude diagram of NGC 6388. The superimposed isochrones have an age of 10.5 and 12.5 Gyr and a metallicity of [M/H]=-0.35 (α–enhanced, Pietrinferni et al. 2006). We assumed a distance modulus $(m - M)_0 = 15.38$ and $E(B - V) = 0.44$, as given by Valenti et al. (2007).

nitudes of the 5 reference stars were between $V = 15$ and $V = 16.3$, thus demonstrating the limiting magnitude gain. Instrumental performances have been evaluated both through the FWHM measurements and through the Strehl Ratio (SR) evaluation over the entire 2×2 FoV (see Fig.1).

The measured FWHM is stable at 2% level over the observed FoV. This is mainly due to the presence of suitable (i.e. bright enough) stars in the FoV, and to their homogeneous distribution. For NGC 6388 we obtained an average FWHM of 0.15 arcsec (0.46 before the MCAO correction),with an average Strehl Ratio of ~10%.

As for the photometric results, we show in Fig. 2 the color–magnitude diagram obtained coupling MAD K_s photometry with ACS/VLT optical one. This is the deepest CMD presently available in the NIR for this cluster, and comes from the analysis of the best 6 frames (in terms of seeing conditions), for an exposure time of 1440 s. The magnitude limit is ~20.5.

This result shows that CMDs with a great level of details can be obtained even for bulge clusters, if using NIR bands and the needed MCAO correction.

Acknowledgements. E. Diolaiti, D. Brast, R. Donaldson, J. Kolb, P. Amico, P. Bagnara, C. Sonke, S. Tordo are warmly thanked.

References

Arcidiacono, C., Lombini, M., Farinato, J., & Ragazzoni, R., 2007, MemSaIt, 78, 708
Bouy, H., Kolb, J., Marchetti, E., et al., 2008, A&A, 477, 681
Ghedina, A., Cecconi, M., Ragazzoni, R., et al., 2003, in SPIE Conference, Vol. 4839, 869
Marchetti, E., Brast, R., Delabre, B., et al., 2006, in SPIE Conference, Vol. 6272, 21
Marchetti, E., Brast, R., Delabre, B., et al., 2007, The Messenger, 129, 8
Pietrinferni, A., Cassisi, S., Salaris, M., & Castelli, F., 2006, ApJ, 642, 797
Ragazzoni, R., 1996, Journal of Modern Optics, 43, 289
Ragazzoni, R. & Farinato, J., 1999, A&A, 350, L23
Ragazzoni, R., Farinato, J., & Marchetti, E., 2000, in SPIE Vol. 4007, 1076
Valenti, E., Ferraro, F. R., & Origlia, L., 2007, AJ, 133, 1287
Vernet, E., Arcidiacono, C., Baruffolo, A., et al., 2005, Optical Engineering, 6601